ENGINEERING CONSTRUCTION WEEKLY

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October 28, 1937

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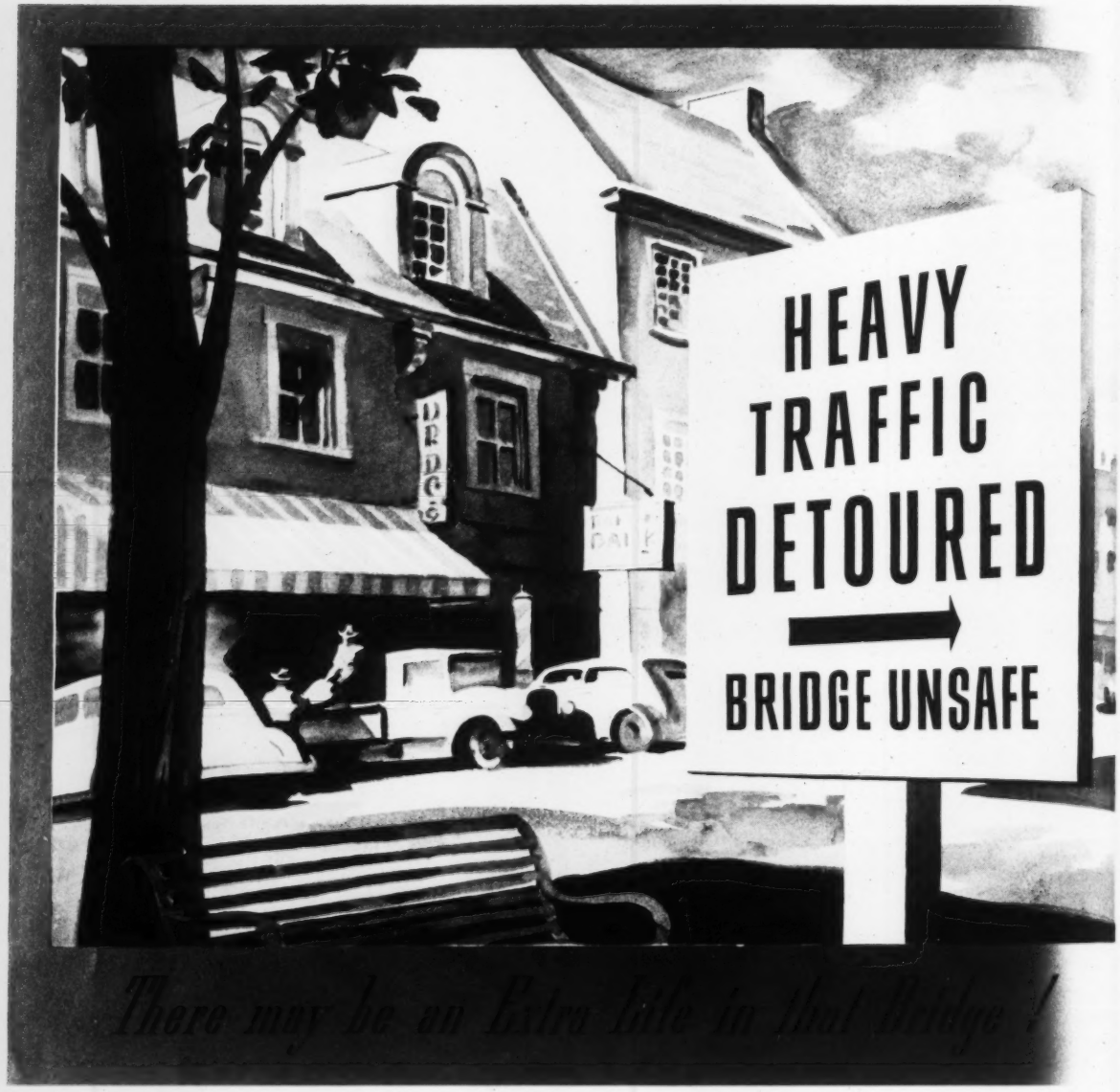

Before complete replacement is prescribed, get the answer to this question: Will a major decrease of dead-load on the existing structure restore serviceability and safety?

In many cases use of light, strong alloys of Alcoa Aluminum for floor systems, walkways, and railings will achieve the required reduction in dead-load and save the structure. The cost is only a fraction of the outlay needed for a new bridge. Usefulness is extended for many years.

Application of Aluminum to give bridge structures extra life has proved its place in sound engineering practice. Bridges so reconstructed demonstrate that: 1. Traffic capacity can be increased; 2. Permissible live load can be increased; 3. Roadway surface can be improved; 4. Stresses can be reduced. ALUMINUM COMPANY OF AMERICA, 2108 Gulf Building, Pittsburgh, Pennsylvania.

An Approach to Reemployment

DESERVING of thoughtful observation is the program recently announced by Lieut. Col. Brehon B. Somervell, local WPA Administrator for New York City. Through it he is trying to help WPA workers develop the incentives and capacities that they must have if they are to qualify for regular employment. He is trying also to put a premium on genuine productive effort by the workers as against the inclination to get by in the laziest way.

For the present the plan applies only to 2,114 employees of the sewing project. Under its terms they are graded and will be paid according to their production. Each worker is assigned to one of two sections. One is composed of those whose records of workmanship have met the highest requirements for quality and output; the other comprises those who have failed to reach those standards. Among the workers in the upper section production units are set up. On the basis of the unit performance over a stated period, the members of each unit will be eligible for higher wages during the next period. The amount of the increase depends on the degree by which their production exceeds certain prescribed standards. Workers who slow up the production of their units may be transferred to a lower classification. Into the grading of performance, quality as well as quantity enters as a factor. Consolidation of sewing centers and greater use of power machines are planned to increase the output of the whole project.

FROM TIME TO TIME this page has been critical of WPA operation on the grounds of inefficient methods, loose management and the undermining of morale amongst its beneficiaries. It has urged, moreover, that governmental unemployment measures should pay more attention to the reconditioning of workers for new jobs with private business rather than harp so constantly on the boundless obligation of the community to provide a living for all applicants regardless of their ability or willingness to render to the community some value in return. Colonel Somervell's program is heartening in its implied consideration of all these points.

The use of modern methods and equipment to increase the efficiency of WPA employees is in striking contrast with the original doctrine of making more jobs by doing things awkwardly. The effort to apply judiciously the principles of management that have been developed by productive industry is in contrast with the loose, political administrative methods that have been so conspicuous on so many jobs. The establishment of incentives that will inspire workers to more productive effort will do more to raise the morale and preserve the self-respect of individuals than does the coddling of those who would merely put in their time regardless of performance. It marks the difference between WORK-relief and work-RELIEF. And that distinction is important.

BUT EVEN MORE fundamental is Colonel Somervell's conscious effort to qualify his people for employment in private industry, for that is the only process by which we actually can achieve any satisfactory solution of the unemployment problem. He has taken counsel and sought the cooperation of both employers and unions in the needle trades, and an essential part of his program is to develop in his workers a competence sufficient to get and hold regular jobs. Heretofore, many who managed to find jobs lacked the skill to combine the requisite speed and quality to keep them. Now each worker has a chance to get ahead according to his will and skill with a regular job as an objective. All this is a constructive approach to *re*employment which is the one safe cure for *un*employment; meanwhile it gets for the community a greater material return for its relief expenditures.

Of course, at this writing, this is but a program. We have yet to see how it works. But Colonel Somervell has a reputation for making things work. And with principles so sound and a field of application so suitable, there is good reason to hope for substantial results. With this experience he may be able to work out a similar program for public works construction and maintenance. And that, Colonel, would be something!

Willard Chevalier

ENGINEERING NEWS-RECORD

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EVERY DAY new machines are put to work in America's industrial plants to manufacture better commodities at higher speed and lower cost. And each advance gives new impetus to our ever rising standard of living.

To the genius of America's machine designers goes all praise for these achievements.

Yet without a like advancement in the science of lubrication, these modern machines would be of little benefit to industry. For no machine can perform without oil; and with each advance in machine design and speed comes a greater need for effective lubrication.

To deal with the problems that grow out of these mechanical developments, Gulf has equipped its laboratories with instruments and machines that put lubricants to the severest tests.

Behind the scenes of American industry today is a group of Gulf scientists who work each day to find better methods and better oils to lubricate machinery. No lubricant is placed in service in the field until it has been thoroughly proved as best for its purpose.

This is why Gulf can make this pledge to industrial plant operators: *Lubrication will continue to keep pace with the technologic advance of industry.* Gulf has the men, materials and equipment to manufacture the finest oils and greases for the machinery of today—and for the machinery of tomorrow as well.

GULF INDUSTRIAL LUBRICATION

· ENGINEERING NEWS-RECORD ·

McGRAW-HILL PUBLISHING COMPANY, INC.

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VOL. 119 *OCTOBER 28, 1937* No. 18

THIS WEEK AND NEXT

THE KENDRICK project in Wyoming has a long feeder canal down the South Platte Valley from the Alcova Reservoir to the 35,000 acres served. Four electric draglines have made low cost records in completing more than half the 59-mile length.

Winter building construction in Milwaukee is no pleasant job unless, for example, you enclose the structure with a wooden box. A Milwaukee contractor made a summer job out of a winter one with plywood sheeting and steam unit heaters. Details are given in an article in this issue.

The most modern processes were called upon in the construction of a 25-mile stretch of asphalt road running north from San Antonio. A complete field laboratory aided the state in maintaining design and control of the paving mixture.

On the banks of the old Raritan, the glories of which have been sung by generations of Rutgers College men, fourteen new sewage disposal plants have been built. This cleanup program is one of New Jersey's big accomplishments in stream pollution abatement.

Following last week's article on the Boston meeting of the American Society of Civil Engineers comes a further one devoted to the all-day meeting of the society's engineering economics and finance division.

FEW JOBS can show worse foundation conditions than those encountered in building the West Side Elevated Highway at New York. Next week's issue will contain an article on the variety of types of caissons used to meet varying conditions. An article on the pile foundations will follow in a subsequent issue.

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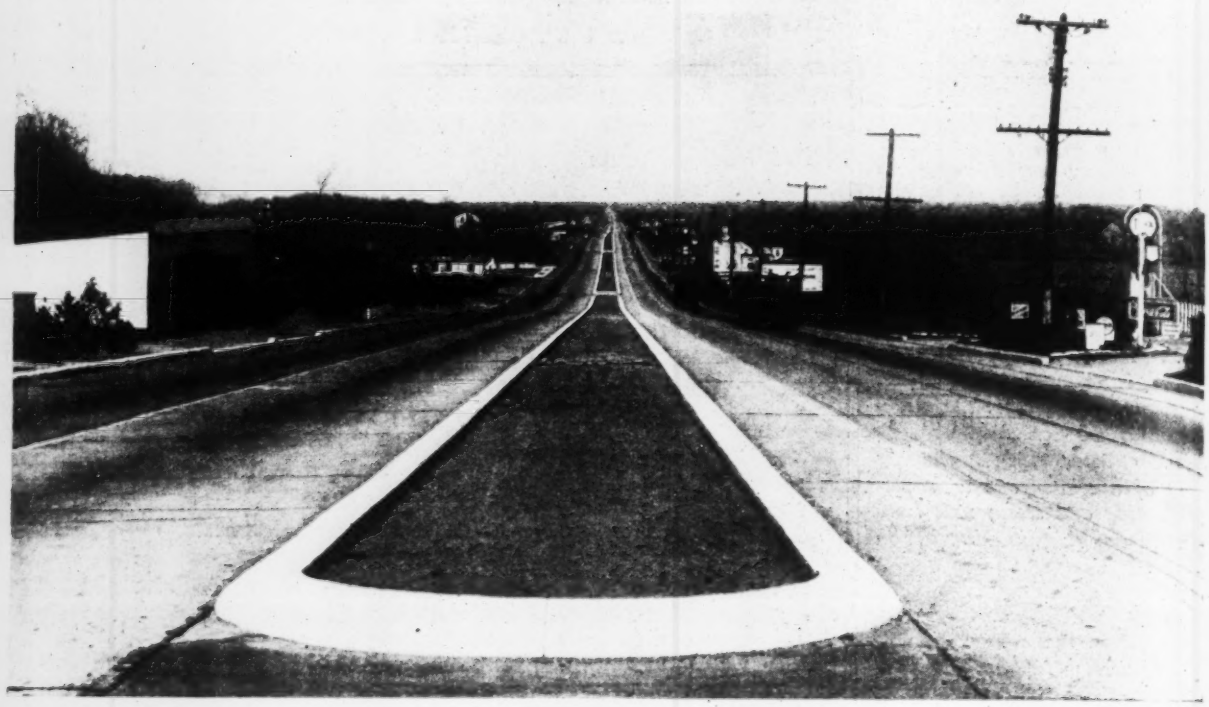
THE COVER PICTURE is of a 3-cu.yd. electric dragline digging for the 59-mile canal of the Kendrick irrigation project in Wyoming.

Number of copies of this issue printed: 29,747

First Cost is Last Cost



Curbing made of Atlas White portland cement on Brunswick Pike, New Brunswick, N. J.
Constructed by New Jersey State Highway Department

This curbing will stay white permanently. It requires no maintenance, no repairs, no replacement

● This is a safe, well-engineered highway. Traffic flows on either side of the center island with no possible danger of head-on collisions.

One big safety factor is the fact that the curbing is white. More than that, it is *permanently* white, because it is made of Atlas White portland cement. Painting will never be necessary.

When Atlas White curbing or traffic markers go in, maintenance worries go out. They require no repairing or replacing. Their whiteness never dims, never washes away. They stay white year after year, clean-cut, easy-to-see guardians of life and limb.

Use Atlas White for your next curbing or marker job. It is your assurance of built-in permanence and safety at low cost. And the first cost of curbing or traffic markers made with Atlas White is the last cost. Universal Atlas Cement Co. (United States Steel Corporation Subsidiary), 208 South LaSalle Street, Chicago.

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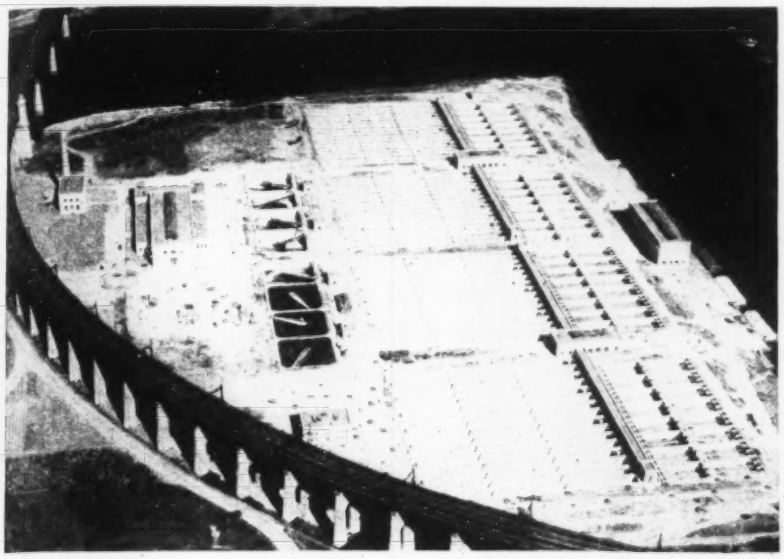
ATLAS WHITE PORTLAND CEMENT FOR MARKERS AND CURBS

THE WEEK'S EVENTS



Fairchild Aerial Surveys

BETTER HERE THAN IN THE EAST RIVER

UNDER the long curve of the Hell Gate approach span, the new Ward's Island sewage treatment plant can handle 190 m.g.d. of sewage from Manhattan and the Bronx which formerly went into the East River. Dedicated Oct. 23, the new $30,000,000 plant is the largest unit in a contemplated program of 38 disposal plants.

From left to right can be seen: the power house, the pump and blower building, primary sedimentation tanks, aeration tanks, return sludge building, final clasification tanks, and sludge storage building. The latter is adjacent to a wharf which will accommodate self-propelled vessels used to transport sludge out to sea.

Road Department Reports On Detroit Traffic

Highway Commissioner Van Wagoner of Michigan has submitted to the city of Detroit a report on Detroit traffic conditions together with a 27-point program of recommendations which was prepared as a result of a study carried on as a cooperative venture by the state highway department, the Detroit police department, and the WPA. The study is not intended as an immediate program, but rather as a general long-term plan which can be acted upon as funds are available.

Outstanding among the recommendations are those for parking control. It is recommended that daytime parking be entirely prohibited in the business district and that old buildings with low value in the regions around the business district be torn down to make room for parking spaces. Buses would connect the parking centers with the business district and an arrangement is recommended by which a single fee would cover parking and bus fare. Also recommended is an ordinance compelling provision for storage space off the street for cars in connection with all future apartment house construction in the city.

Construction of two new 120-ft. wide crosstown highways is recommended and widening of several other streets. It is suggested that speed limits be raised to 20 miles an hour in the business district, 30 miles on through streets outside the center, and to 45 miles an hour on through streets in sparsely settled areas.

Also recommended is the creation of a traffic commission with a full-time engineer in charge, the commission to be composed of the heads of the existing public works, public safety, legal, and transportation departments.

A.G.C. Votes to Set Up Labor Division

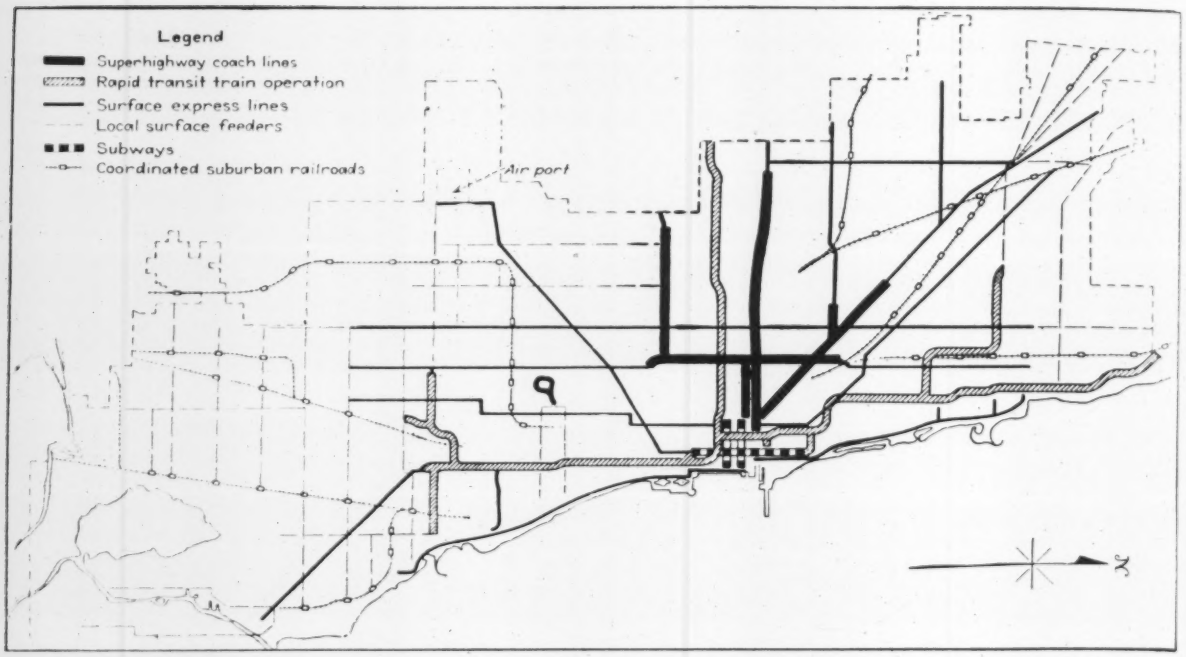
Associated General Contractor adopt new attitude in labor relations at Fall Board Meeting

Making a distinct change in attitude, the Associated General Contractors at the Fall Board Meeting in Atlantic City last week voted to establish a department of labor relations within the national organization. The A.G.C. has never had a definite labor policy because of differences of opinions among its membership, which includes all classes of general contractors over the country who work both open and closed shop and on the American plan. Yet the association has always been interested in labor and wage conditions, especially in national legislation such as the Bacon-Davis prevailing wage act. The action taken at the meeting will set up a special committee or division in the national headquarters to act in an advisory capacity only, without power to effect national agreements or to act for the membership in any question without specific authority. It is agreed that action taken in behalf of one or more of the chapters or branches will not bind the remaining chapters. The labor department will act as a clearing house for information on labor affairs, especially as to action taken by the various chapters. If requested, the department will act as official representatives of any group or chapter in labor relations. Officers of the association point out that for the first time the general contractors of the country will have a national voice in labor questions.

Reports revealed that 30 chapters of the Associated General Contractors are now involved in direct labor agreements. Some of the agreements are made in the name of the chapter; others are by chapter members operating under another group name, while still others are in the name of individual members. These agreements are largely the result of independent action on the part of the chapters.

Further interest in labor problems was evident at the Atlantic City meeting in an interesting discussion of ap-

(*Continued on page 698*)



UNIFIED TRANSIT SYSTEM PROPOSED FOR CHICAGO

Chicago Plans Transit System

Mayor Kelly proposes unified and expanded system of rapid and surface transit.

UNIFIED operation of local transportation agencies in Chicago received the impetus of a report Oct. 19 from city officials which made public a coordinated plan of single reorganized ownership, a reoriented physical plan and a meshing of elevated and subway rapid transit, surface street car, and automotive facilities.

First, Mayor E. J. Kelly presented a report to the City Council Committee outlining a plan that had been worked out under the direction of Philip Harrington, traction engineer (loaned to the city from the Sanitary District of Chicago more than a year ago). This plan is for unified operation, a reasonable valuation, modernization and extension of facilities for both surface lines and rapid transit service, subways and superhighways and, where feasible, for coordination of local transit with suburban railroad service.

On Oct. 20 the report was presented to the Federal Court, which has jurisdiction by reason of receiverships of both surface and elevated systems. Franchises long ago expired, and the city therefore has a whip hand in forcing a merger. The surface lines oppose unification since they are making money while the elevated system does not pay.

The Surface Lines have been refused a separate franchise, and committees of the various interests have failed to agree on a comprehensive financial and physical program. Hence the city has undertaken to write its own solution of the problem, developing an engineering plan and a program of improvements "reasonably feasible of accomplishment under all the physical, financial and legal circumstances."

The plan, which has not yet been completed and assembled in finished form, embraces the following general engineering features:

1. Unified operation of all local transportation public utilities with universal transfer privileges.

2. Construction of a subway for rapid transit train operation in State St. and Chicago Ave. extending from a connection with the elevated rapid transit structure near Chicago Ave. to a connection with the southside elevated structure at a point just south of Roosevelt Road.

3. Construction of a subway for street car operation in Washington St. from Des Plaines St. to Grant Park.

4. Construction of a subway for street car operation in Jackson Blvd. from the Van Buren St. tunnel to Grant Park.

5. Construction of a six-lane elevated highway in Randolph St. extending from Paulina St. to Jefferson St., with connections at Paulina St. by ramps to Washington Blvd., Warren Ave. and Lake St.

6. Conversion of the Douglas Park, Paulina St., Lake St., Logan Square Humboldt Park elevated structures of the Rapid Transit Co. into widened elevated highways over which private automobiles as well as public carrier coaches may operate.

7. Extension of the elevated structure southeast to Lake St. in Milwaukee Ave., providing elevated coach service from the northwest side direct to the downtown district.

8. Improvement of the remaining structures of the Rapid Transit Co. and the modernization of their equipment to provide fast, up-to-date train service on the north, south and Garfield Park divisions of the rapid transit system.

9. Installation of a modern and extended system of surface facilities, combining street cars, trolley coaches and buses.

10. Installation of a system of express bus routes on streets and boulevards to give faster service to areas not directly reached by elevated rapid transit service.

11. The construction of an underground facility in Grand Park for the daytime storage of extra cars and coaches needed only in the morning and evening rush hours, thus preventing the unnecessary congestion caused by returning empty vehicles to outlying barns and returning them empty in the evening.

(*Continued on page 696*)

THE CURRENT TREND

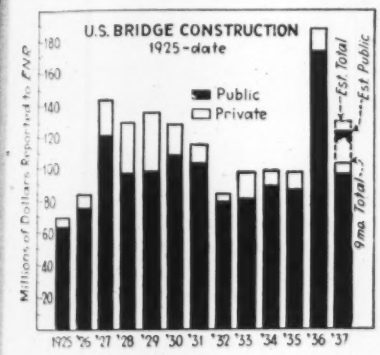
This week's news of contract volume and construction cost factors

Bridges in Fourth Best Year

Bridge construction shifts geographical distribution, shifts from private to public

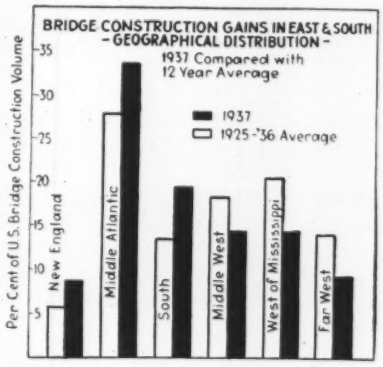
At the current rate, bridge construction this year will be the fourth highest on record as reported by *Engineering News-Record*. The record year is 1936, a reflection of the large grade crossing elimination program financed by federal funds. The 2nd and 3rd high years are 1927 and 1929 with totals of $144,000,000 and $137,000,000 respectively. Bridge construction from 1925 to date has ranged from $70,000,000 per year to $188,000,000 and averaged $115,000,000 for the 12 years preceding 1937. This year's volume points toward a total of $136,000,000.

Prior to 1932 bridge construction accounted for 2.7 per cent to 4.8 per cent of the total engineering construction volume reported by *Engineering News-Record*. From 1932 to 1936, bridges made up 6.2 to 9.2 per cent of the total. This year's bridge volume is 5.4 per cent of the total construction of all types reported.



Private construction of bridges reached its maximum in 1929 with a total of $37,596,000 and its minimum in 1932 with $4,275,000. The federal pressure behind grade crossing elimination accompanied by public financing of this type work, of which the railroads formerly financed a heavier share, has been responsible in large measure for the low private bridge construction volume during the recovery years.

Both the grade crossing elimination program and damage by flood have contributed to a shift in the geographical distribution of bridge construction. The Middle Atlantic states, always great bridge builders, are increasing their share of the United States total from a 12-year average of 29 per cent to 34 per cent in 1937. New England's 12-year average of 6 per cent compares with 9 per cent for 1937; South 13½ per cent average compares with 19½ in 1937. The Middle West average of 18 per cent drops to 14 per cent in 1937, West of Mississippi drops from an average of 20 per cent to 14 per cent in 1937 and Far West from 14 per cent to 9 per cent.



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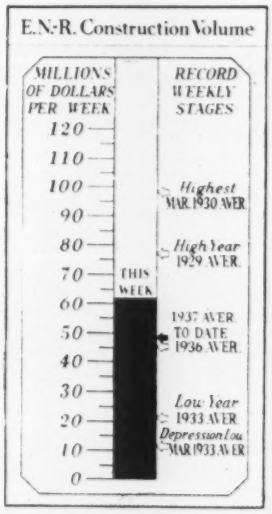
Business Briefs

AIR CONDITIONING systems and equipment orders reported by Bureau of the Census for August totaled $4,045,405 compared with $5,800,617 in July and $3,733,535 in August last year. The 8 month's total is $48,706,668 compared with $29,370,220 a year ago.



THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending Oct. 29 1936	Oct. 21 1937	Oct. 28 1937
Federal	$3,696	$3,079	$4,640
State & Municipal	24,990	15,786	22,476
Total public	$28,686	$18,865	$27,116
Total private	16,163	25,081	35,750
TOTALS	$44,849	$43,946	$62,866
Cumulative 1937 (43 weeks)			$2,075,809
1936 (44 weeks)			$1,957,801

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative. 1936 44 Wks.	1937 43 Wks.
NON-FEDERAL	$783,470	$1,327,299
State & mun. bonds	428,938	430,038
Corporate securities	210,138	489,196
PWA loans, grants	119,396	178,126
RFC loans	24,998	29,939
Fed. aid for highways	.....	200,000
FEDERAL	$691,237	$746,223
TOTAL CAPITAL	$1,474,707	$2,073,522

ENR INDEX VALUES

Index Base	1913	1926
Construction Cost (Oct.)	214.55	117.55
Construction Volume (Sept.)	148	65

THIS WEEK'S LARGE CONTRACTS

Power plant, Public Service Gas & Electric Co., Burlington, N. J.	$10,000,000
Housing development, Brookdale Homes, Inc., Nutley and Bloomfield, N. J.	2,100,000
Housing development, Commonwealth Land Co., Summit, N. J.	2,225,000
Residential development, Grandyle Land Corp., Grand Island, N. Y.	1,500,000
Housing development, L. Gold, Ridgewood, N. J.	1,650,000
Housing development, General Housing Co., Cleveland, O.	6,750,000
Apartment, Dillerwood Realty, Inc., New York, N. Y.	825,000
State hospital, Selinsgrove, Pa.	1,678,000
Cables, floor and approach viaducts, Bronx-Whitestone Bridge, N. Y.	4,848,000
Dredging Wax Lake Outlet Channel, St. Mary's Parish, La.	1,702,000
Highways, Texas	821,000
Baseball stadium, Detroit, Mich.	600,000

Bonneville Advisers Are Appointed

Representatives of four agencies will consult with administrator Ross on Bonneville problems

The four-man advisory committee that will co-operate with J. D. Ross, newly-appointed administrator of the Bonneville power development on the Columbia River, has been completed by the action of the various federal departments concerned. The members of the committee will act as liaison officers to keep the administrator in touch with plans of their respective agencies which may affect or be affected by the Bonneville development.

Representing the Department of the Interior will be Frank A. Banks, construction engineer of the Bureau of Reclamation in charge of the Grand Coulee development, on the Columbia River 200 miles above Bonneville. Mr. Banks has been with the Reclamation Bureau since 1906 and was formerly in charge of construction at the American Falls Dam in Idaho and the Owyhee Dam in Oregon.

The Department of Agriculture will be represented by Halbert Selby, agricultural economist, who has been connected with land utilization studies for the first AAA and the Resettlement Administration. He is at present in charge of land use planning for the states of Oregon, Washington and Idaho, with headquarters at Portland, Ore., under the Bureau of Agricultural Economics.

Colonel Thomas M. Robins, division engineer for the Northern Pacific Division, Corps of Engineers, will act as representative of the War Department. Col. Robins has long been identified with the development of the Columbia River region's water resources, his eight-year service at his present post covering the period of construction of the Bonneville project.

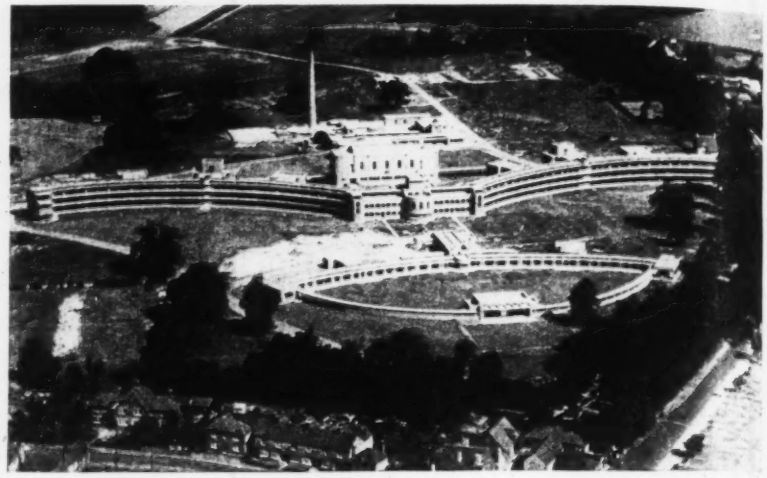
The Federal Power Commission will be represented by its chief engineer, Roger B. McWhorter.

• • •

Local Housing Authorities To Meet in Washington

A national conference of local housing authorities will be called shortly after Nov. 1 by Nathan Straus, newly appointed administrator of the U. S. Housing Authority. The conference will discuss the half billion dollar housing program established by the last Congress and lay plans for getting construction under way quickly.

Mr. Straus states that preparatory work for the program will occupy several months but that immediately thereafter he hopes to get construction work under way and proceeding at a reasonable rate. Pointing out that although the country requires about 900,000 additional family units a year to meet its housing needs, only 75,000 units were built in 1935, 250,000 in 1936, and about 400,000 this year. Mr. Straus stated that "Despite everything the Wagner-Steagall Act can do or I can do as administrator, we are facing the worst housing shortage in the history of this country."



Globe Photo

A PLACE IN THE SUN

THE BUILDINGS of the new Harefield Sanitorium at Middlesex, England, were laid out with the aim of giving the maximum amount of sunshine to the wards. The concave wings in the middle distance have low corridor verandahs for the patients. In the foreground is a single-story building for the children's ward, laid out in the same manner.

• • •

Chicago Transit Plan

(*Continued from page 694*)

12. The removal of the Wabash Ave. and Lake St. sections of the Union Loop after the recommended subways are put into operation.

13. The coordination of local transit facilities with suburban railroads to make available faster service to those outlying areas which cannot be directly reached by the local company's rapid transit and express bus service.

The estimated construction cost for the city is $59,000,000, and it is believed funds are now available without levying taxes or assessments. The potential sources of public funds are as follows: Federal and state road funds; Cook County bond funds; PWA; WPA; the city traction fund; compensation from unified company; fuel and vehicle tax funds.

The estimated capital investment required of the unified company for improvements is $98,000,000, spread over a period of nine years. Of this amount, an investment of $60,000,000 is required in the first four years, and $38,000,000 in the following five years. Much of this investment is required to replace worn-out or antiquated vehicles with new and modern equipment which can be purchased on the equipment trust plan.

The improvements required of the company include the rehabilitation of about two-thirds of the surface lines for improved street car operation, the conversion of one-third of the street-car system to trolley coaches and gas buses, the installation of 170 mi. of surface express buses, and 130 mi. of extensions of line, as well as the installation of the subway, rapid transit and superhighway lines of modern steel equipment and all up-to-date safety devices. The public program will provide 4.43 miles of subway and 20.39 miles of much-needed superhighways.

• • •

Elevated Highway Contract Is Awarded

Extension of New York City's West Side Elevated Highway south of the Holland Tunnel toward the Battery approached the stage of superstructure erection recently with the award of the first contract to James Stewart & Co. The section involved is between Canal and Duane Sts., a distance of about 3500 ft. Foundation work south of Duane to Cedar Sts. (a distance of about 2800 ft.) is still under way by Poirer & McLane. The highway is being built by the borough of Manhattan.

Wards Island Plant Is Dedicated

Ickes praises sewage disposal project as major step in improvement of city of New York

The Ward's Island sewage treatment works, New York City's largest disposal plant, was dedicated Oct. 23 before an audience of more than 1,000 who heard PWA Administrator Ickes describe the plant as "of equal if not of greater importance to the welfare of the city as many a more spectacular project." Other speakers at the ceremonies were F. H. LaGuardia, Mayor, William F. Carey, commissioner of sanitation, and Walter D. Burger, deputy commissioner in charge of engineering.

The new plant, of the activated sludge type and with a capacity of 190,000,000 gal. per day, will treat about one-fifth of the city's sewage. Located on an island in the East River, the plant is connected by tunnels with interceptor sewers serving parts of the boroughs of Manhattan and the Bronx. The total connected population is about 1,200,000.

Sewage from the 6¾-mile Manhattan interceptor discharges into a grit chamber before it enters a tunnel 300 ft. underground. Under the river channel, the tunnel drops about 200 ft. more to avoid rock faults. The Bronx interceptor sewer is 2½ miles long, and it likewise passes through a grit chamber before it drops 150 ft. to pass under the Bronx Kill and Little Hell Gate.

Sludge from the plant will be carried 10 miles out to sea in three sludge vessels now under construction. These are diesel-propelled ocean-going steel craft 260 ft. long, each with a capacity of 410,000 gallons.

Work on the Ward's Island project, which cost about $30,000,000, was started in 1931. Lack of funds caused a halt in operation until August, 1935, when the city received a PWA loan and grant totaling $25,245,000.

The original construction and most of the works were designed by Fuller & McClintock, consulting engineers, New York City. Walter D. Burger, deputy commissioner, was in charge of the project for the city, assisted by Richard H. Gould, chief engineer.

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Housing Council Formed In Milwaukee

A Milwaukee housing council was organized Oct. 16 at an all-day meeting of 250 delegates from 100 civic, financial, commercial, political, labor and church groups. The council proposes an educational program with a speakers bureau, investigations of slum clearance and federal housing projects. Housing for low-income groups and overcrowding in Milwaukee was stressed in the meeting.

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Welding Society Meets In Atlantic City

The first annual award of the Lincoln gold medal was made at the annual meeting of the American Welding Society in Atlantic City the week of October 18, the recipient being T. M. Jackson, of the Sun Shipbuilding and Dry Dock Company, Chester, Pa. The award was made for a paper entitled "Welding in Tanker Construction", published in the October issue of the Society's *Journal*.

PHILIP G. LANG, JR.
New president of welding society

In his opening address, A. E. Gibson, president, reported nearly 100 per cent increase in the society's membership during the past year. He also pointed out that many city building codes have been written and revised to include welding, and that the society has cooperated in welding research.

Papers presented, which will be abstracted in a later issue, covered such subjects as: Fatigue Tests of Butt Welds in Plates; Welded Girders with Inclined Stiffeners; Effect of Welded Top Angles on Beam-Column Connections; Welding—an Aid in Dam Construction.

Election of Philip G. Lang, Jr., engineer of bridges of the Baltimore & Ohio Railroad, as president of the society was announced at the meeting. Mr. Lang has been with the Baltimore & Ohio for 30 years and has been engineer of bridges since 1921.

Water Tower Fails In Yonkers

Forty-six year old brick masonry water tower fails without warning

A 120-ft. brick masonry water tower supporting a 285,000-gal. steel water tank on a hill in Yonkers, N. Y., fell October 23, releasing a flood of water and crumbled masonry which caused damage to nearby houses and injured six persons. The tower, known as the Nodine Hill Tower, was part of the city water works system of Yonkers and served the high pressure lines. Its foundation consisted of a 3-ft. brick masonry wall based on a rock outcropping. The lower 40-ft. of the tower, which had an inside diameter of 28 ft., consisted of a 2-ft. thick brick wall; the next 40 ft. was 18 in. thick, and the final 40 ft. was 15 in. thick. For 8 ft. farther, a 15-in. brick wall surrounded the 20-ft. steel tank with a capacity of 285,000 gal.

An application for a PWA project to demolish the tower and construct a new one has been approved but no money was allotted. A WPA project for repair of the roof of the tower was under way at the time of the failure, although no work was actually going on when the tower fell.

The Nodine Hill Tower was built in 1891; P. J. Flannery was the contractor and the work was done under the supervision of William H. Baldwin, engineer. The tower was designed by Edwin A. Quick and Son and the stand pipe was built by Morris Lasher & Co. The total cost of construction of the tower was $35,000, of which $21,000 was for construction of the tower and $9,000 for construction of the tank, the remainder being for land purchase.

Pending the results of an investigation which has been started by the city water department, water officials are of the opinion that the failure was in the tank rather than in the tower, and that the rush of water from a break in the tank caused the destruction of the tower itself.

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Women Allowed to Inspect Buffalo Sewers

The Buffalo, N. Y. Sewer Authority has decided to defy the superstition that women underground bring bad luck and will permit women to inspect the progress of the $15,000,000 Buffalo sewer project as well as men. The question of whether women should be permitted came up when the authority decided to hold a series of public inspections of the project.

A.G.C. Votes to Set Up Labor Division

(Continued from page 693)

prenticeship training. Wm. Joshua Barney, of New York, chairman of the committee on apprenticeship, presented an illuminating preliminary report in which he stressed six basic questions that must be considered in formulating an apprenticeship plan. Briefly, they are: 1. Responsible employer groups will have to assign apprentices to jobs and determine the ratio between journeymen and apprentices on every project; 2. wage rates for apprentice workers must be determined on a basis fair to the worker, the journeyman and the employer, preferably based on a sliding percentage of skilled wages for the trades in question; 3. responsible labor groups must see that apprentices live up to their agreements; 4. labor and employer groups must set up a curriculum and course of training to be followed; 5. the status of the apprentice at the end of training period must be determined; 6. the apprentice must make a declaration of good faith and prove his qualifications before being selected for a course of training.

Apprentice training was again brought up at a dinner meeting of the cooperative committee of the A.G.C. and the American Association of State Highway Officials, at which possibilities of training Civilian Conservation Corps members as highway workmen were discussed. Dean Snyder, of the U. S. Employment Service, and J. L. Harrison, U. S. Bureau of Public Roads, participated in the discussion. The contractors pointed out the difficulty of training their own equipment operators and other skilled help because the stipulated high wages for skilled positions made it imperative that the best men possible be secured for maximum production and low operating costs. Mr. Harrison suggested that if arrangements could be made to use CCC men as apprentices the specified labor conditions might be changed accordingly. The joint committee will make further studies and report at the next annual convention of the association.

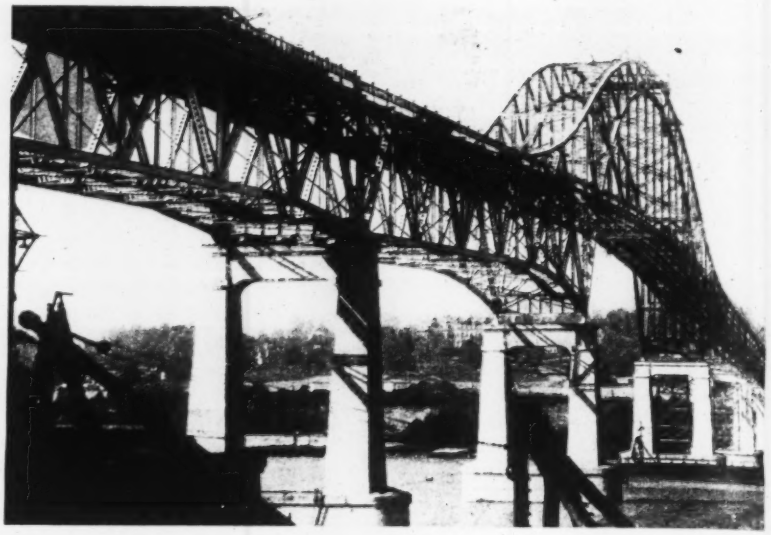
The A.G.C. protested the curtailment of PWA activity, declaring that the President should continue PWA until all the funds allotted by Congress for this purpose have been expended. The association also took exception to curtailing PWA ahead of WPA activities, maintaining that as long as relief is necessary PWA should be continued.

The headquarters staff reported on progress made in revising the A.G.C. equipment ownership expense manual and the accident prevention manual. The equipment manual is being enlarged to include all the newest types and sizes of equipment. Difficulty is encountered in the setting of depreciation rates because of the growing tendency to work equipment two and three shifts daily in some parts of the country, which throws the customary monthly depreciation rates out of balance. Then, too, attempts are being made to use depreciation schedules as rental rates, which was never intended by compilers of the manual, for there are other items to be considered in renting schedules beyond depreciation costs.

A new form of governing board will be presented to the next convention for approval. Twelve districts have been proposed, each of which will elect three members to the board, and the three members from each district must represent heavy, highway and building contractors. Directors will serve for three years; one-third of the board will be elected each year.

A committee, headed by Chas. V. Burghart of Chicago, was appointed to represent the A.G.C. in cooperating with the American Association of Railroads. The contractors now have cooperating committees with the national associations of architects, civil engineers, subcontractors, highway officials and railroads.

The annual convention will be held in Washington, D. C. next February. Edward P. Palmer, of New York, was nominated for president; Guy F. Atkinson, San Francisco, was nominated for vice-president at large. Officers will be elected at the convention.



PATTULLO BRIDGE TO OPEN SOON

A WELDING TORCH will cut an iron chain Nov. 15 marking the official opening of the $4,000,000 Pattullo bridge across the Fraser River at New Westminster, B. C.

The bridge, built for the British Columbia government by the Dominion Bridge Co. and the Northern Construction Co., carries four traffic lanes with a total width of 49 ft. The total length of the steel work is 2,450 ft., and, including the approaches, the bridge is 6,175 ft. long. It contains about 5,300 tons of structural steel, and has a clearance above high water of 146 ft.

An interesting feature of the construction of this bridge was the use of light steel trusses as reinforcement for the concrete girders of the approach spans. These reinforcing trusses served also as falsework, supporting the concrete forms during construction.

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Big Power Plan Studied In British Columbia

The British Columbia Land Department has announced that studies made by the department indicate the feasibility of a 1,000,000-hp. hydro-electric development which would be achieved by reversing the flow of the Nechako River, which now runs east to the Fraser River near Prince George, making it run west to the sea on Dean Channel by passing the water under the Coast Range.

The Nechako project would involve construction of a 10 mile tunnel through the hills to carry the waters of Eutsuk and Whitesail lakes into the headwaters of the Kimsquit River, which runs into the head of Dean channel. Surveys of the project are now being made.

Unions and Turbines Are Discussed

One hundred gather at Asheville for Tennessee Valley section meeting of A.S.C.E.

With more than 100 in attendance, the two-day meeting of the Tennessee Valley section of the American Society of Civil Engineers at Asheville, N. C., October 21-22 brought out numerous discussions of a variety of subjects of timely interest to the profession, including particularly the unionization movement, modern trends in hydraulic turbine design and the economic and social possibilities of the Blue Ridge Scenic Parkway.

Consensus of the discussion of unionization was to the effect that the real need of the profession was for elevation of engineering to the plane enjoyed by the medical and legal professions. The necessity for a distinction between the technical employee and the engineer also was stressed by several speakers. Moral obligations of every member of the profession to the undertakings for which he is responsible also was pointed out as eliminating any possibility of the ordinary union methods among engineers.

While some opinions were expressed that compulsory registration of engineers offered a solution of those problems of the profession which the union movement is undertaking to solve, George T. Seabury questioned whether this was the case. He pointed out that the men in the profession automatically are divided into four groups: (1) draftsmen, calculators and others who are functioning as skilled employees rather than as engineers; (2) young college men who might for a time be in class (1); (3) engineers employed by large corporations or by public bodies; (4) independent engineers. In his opinion the union movement is likely to make important progress only in class (1).

Mr. Seabury also stated that the American Society of Civil Engineers has for a long time been engaged in drafting recommendations for a schedule of fees and of salaries which engineers might expect. He is of the opinion that the matter may be approved at the January meeting.

Mr. Seabury further pointed out that an exact comparison between the engineer and the doctor or the lawyer was impracticable, because the doctor and the lawyer constantly deal directly with their clients, while engineers are largely employed in numbers by corporations and governments.

"Trends in the Design of Hydraulic Turbines," presented by R. E. B. Sharp, hydraulic engineer of the Baldwin-Southwark corporation, brought forth various comments. Mr. Sharp considered the following points: Increase in specific speed as a means of obtaining higher r.p.m. and lower generating costs; increase in unit capacity and overall dimensions; development of new types.

So far as the hydraulic engineer is concerned, Mr. Sharp stated, runners having a diameter of 35 ft. are entirely feasible. Engineers of the TVA pointed out in the discussion that while such a great increase in size, as compared with the maximum of about 22 ft. used by the authority, might be feasible for the hydraulic engineer, it would present very serious problems to the structural designer. In fact, the discussion indicated that the method of approach in the design of the structure carrying such large wheels would have to be approached from entirely new angles.

R. Getty Browning, locating engineer of the North Carolina State Highway and Public Works Commission, discussed the economic and social affects that may be anticipated from the construction of the 440-mile Blue Ridge Scenic Parkway extending from the Shenandoah National Park in Virginia to the Great Smoky Mountain National Park in Tennessee and North Carolina. Mr. Browning anticipates that this undertaking will fully justify the cost of building it through the benefits to be obtained from the traffic that he considers certain will use the parkway. He bases this opinion largely on the remarkable volume of traffic on the Skyline Drive.

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Falsework Failure Kills Four

Failure of the falsework supporting the floor forms in the tower of a chapel being built at Villa Scholastica College, Duluth, Minn., Oct. 21 caused the death of four men and the injury of three others.

The seven men were finishing the pouring of a 4-in. concrete floor slab 28x30 ft. when the falsework supporting the form failed and dropped men and concrete 75 ft. Several salamanders fell with the concrete and some of the men were burned.

Inquiries are being made by a coroner's jury, the State Industrial Bureau, and the county attorney. Adolph Anderson, city building inspector, stated that preliminary investigations made by him indicated that the falsework supports were inadequate to support the load.

Contractors on the project were McGough Bros. of St. Paul.

Regional Directors Named for PWA

Heads appointed for seven regional offices to replace present state organization

Secretary Ickes has announced appointment of six of the seven regional directors who will head up the revised PWA field staff. Under the new set-up, the state PWA offices will be closed Nov. 1 and their functions taken over by the new regional offices. This action is being taken in the interests of economy, now that PWA is taking no more new projects and the duties of the field staff are restricted to finishing up projects now under way.

In charge of Region 1, including Maine, New Hampshire, Vermont, New York, Massachusetts, Connecticut, Rhode Island, Pennsylvania, Marylandy Delaware and New Jersey, will be Maurice E. Gilmore, now PWA state engineer inspector for New York State. He will have headquarters in New York City.

David R. Kennicott will be director of Region 2 with offices in Chicago. Now state director for Illinois, Mr. Kennicott in his new position will have jurisdiction over Wisconsin, Michigan, Illinois, Indiana, Ohio and West Virginia.

Region 3, with headquarters at Atlanta, will be headed by Howard T. Cole, now state engineer inspector for Georgia and Alabama, and will include Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Alabama, Mississippi and Florida.

Region 4, with headquarters at Omaha, includes Montana, Wyoming, North Dakota, South Dakota, Nebraska, Minnesota, Iowa and Missouri and will be headed by Robert A. Radford, now state director for Minnesota.

George M. Bull, now state director for Colorado, will be in charge of Region 5 with headquarters at Fort Worth, which includes Colorado, New Mexico, Kansas, Oklahoma, Arkansas, Louisiana and Texas.

No director has yet been selected for Region 6 which has headquarters in San Francisco. This region includes California, Nevada, Utah and Arizona.

In charge at Portland, headquarters of Region 7, will be Claude C. Hockley, now state director for Oregon, who will have jurisdiction over Washington, Oregon and Idaho.

All the regional directors were chosen from the existing PWA organization, and their assistants and staffs will be chosen as needed also from the present PWA staff in each region.

News Continued on page 727

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Zoning Defended

Sir: The article entitled "Zoning is a Failure" by W. L. Henderson of Detroit, which appeared in the Sept. 9 issue, is typical of the type of realtor who is interested only in the immediate dollar. His statement that he has for eighteen years endeavored to discover someone who has a good word to say for zoning indicates that he has not had much association with people out of his own class. During those eighteen years he mentions the zoned communities in the United States have increased in number to 1,302 with a population of nearly 51,000,000, which is approximately 40 per cent of the entire population of the United States.

This increase has not been without opposition in the courts; but such opposition has in reality been productive because it has clarified the law on the subject and caused the courts to sustain police power zoning in communities all over the United States from the Atlantic to the Pacific and from the Lakes to the Gulf. Zoning is an important part of planning. Streets, parks, boulevards, harbors, etc., are poorly planned unless some steps are taken to control the development of abutting property and to control land uses. Zoning does just this. Cities such as Detroit which have spent millions of dollars for street widening without paying any attention to what may develop on these streets after the expenditures for widening and other developments have been made, are taking chances that the good work done in widening thoroughfares will largely be nullified by anti-social developments along them. It is true, of course, that mistakes have been made in zoning ordinances and that zoning ordinances have been overturned as a result of these mistakes. It is also true that improper amendments may be made. But it is also true that mistakes are made in all human endeavor and that any legislative body may enact unwise legislation. Just because mistakes may be made is no reason why we should refrain from attempting to correct the numerous bad conditions in the layout of many American cities which have been brought out through a lack of planning.

The suggestion that the work of carrying out city plans proceed under the power of eminent domain is very common, but it is not practicable. If such attempts were made on a large scale, it would mean impossible outlays, extortionate prices for the land owners, and fat fees for realtors. No one knows this better than Mr. Henderson.

In his cry about confiscation, etc., Mr. Henderson seems much concerned about the individual. He does not seem to realize that proper zoning ordinances afford the basis for a municipal growth along right lines which will promote a sound development and a proper stabilization of values. He seems not to be concerned at all about the public necessity and convenience.

Madison, Wis.
Oct. 12, 1937

M. W. TORKELSON
Director of
Regional Planning,
Wisconsin State Planning Board.

Polarized Headlights

Sir: It seems to be a generally accepted idea that the only solution to safer highways at night is an overhead lighting. Mr. Wood in his article "Road Lighting for Seeing" (*ENR Sept.* 23, p. 516.) discredits attempts at improving headlights to reduce glare from approaching vehicles as a solution to the problem because of the reduced visibility resulting from such action.

At an exhibit sponsored by the Indiana University Extension Service at the State Fair in 1936 an actual demonstration was shown whereby headlight glare was not only reduced but actually eliminated entirely by using headlight lenses and windshields of a special material which polarized all light passing through them, installed so that the polarizing effect of each was normal to the other. The effect was to screen from the driver the polarized light from the approaching headlights; the only light reaching him was the light from his own headlamps reflected in those of the other car.

Provided this system is practical and economical enough to be universally used, the use of headlight lenses capable of polarizing light could be made mandatory by law.

New automobile models could offer the advantage of a polarizing windshield, while owners of older models could be content with slipping a sheet of polarizing material over just a portion of their windshield. When the time arrived that the system could be said to be of universal use, headlight candlepower could be stepped up to an unlimited degree, equal to or better than that provided on modern-day locomotives.

Chicago,
Oct. 9, 1937

W. H. STEVENSON

Engineering Not Auxiliary

Sir: The Brookings Institute report on possible coordination of executive agencies of the federal government, as partially reported in the Sept. 2, 1937 issue of the Engineering News-Record, must have a very limited and narrow conception of professional engineering when it states: "Neither the ascertainment of the need for new construction nor the operation of completed structures includes functions which could properly be exercised by a public works construction agency. . . . Engineering is an auxiliary service." As a matter of fact engineering is the fundamental service in a Department of Public Works.

A Department of Public Works would not and should not be limited to merely construction. It should be a department in charge of a nationally known competent civil engineer. The functions which the institute says could not be properly handled by such an enginering department are exactly what are handled by broadly experienced engineers. Professional engineering does not consist of only the design and construction of various projects but does include the investigation of the need of them from a viewpoint of being economically sound to finance, construct, operate and maintain as well as being desirable. Who better could decide such things than a broadly experienced engineer, who makes it his life work?

Of course, such a department would have subdivisions the same as any well organized department. A public works department would be a central planning agency. Just why the engineering work should be done by engineers and reports submitted to a department head who is not equipped to argue the pros and cons when policies, basically engineering policies, are decided, is not clear.

Bogota, N. J. SPENCER A. SNOOK
Oct. 13, 1937

Construction by the WPA

Sir: The article "The Case for PWA" in the Sept. 23 issue of *ENR* and also your editorial dealing with the same subject were of very great interest to me. I am greatly concerned that the construction industry could be used in the manner described without vigorous protest from every engineer and contractor who makes his living in the industry.

You should be congratulated upon calling attention to the harm done by the WPA, which is now causing unemployment in and the breaking up of construction organizations, at the same time tending to degrade the American working man.

The article calls attention to the $25,000 job limitation originally imposed on the WPA. This, of course, has been entirely forgotten. At the present time WPA administration is building up permanent organizations in many American cities and unless a strong and vigorous protest is made, these organizations will usurp and take the place of the organizations which have been built up by engineers and contractors over the past many years.

Let me call your attention to an instance of the ambitious program on which WPA is now embarking in New York City. The city is to build an airport at North Beach in the Borough of Queens which will require about 9,000,000 cu.yd. of fill to be excavated and transported from the adjacent Rikers Island. This work is to be done by the WPA in New York City and while, if it were performed by a contracting organization it would probably cost from $2,500,000 to $3,000,000, unquestionably it will cost many times that amount when performed by WPA. This is only the start of this very important project and doubtless before it is finished WPA will have performed at tremendous expense construction work which would be performed by contractors amounting to seven or eight million dollars, while at the same time, engineers, contractors and their organization of bona fide and experienced construction men will lack employment until they are qualified by poverty to be employed as WPA workmen.

We thoroughly agree with the writer of this article that WPA must be gotten out of the construction business as early as possible and until cities are ready to resume their own public works construction, the PWA should be prepared to carry out these projects through the normal, organized construction channels.

We hope you will continue these articles until the construction industry is roused from its lethargy and that protests to the administration in Washington will compel correction of this great injustice upon the construction industry and upon the public.

New York, N. Y. EDMUND A. PRENTIS
Oct. 8, 197

Breakwater Construction

Sir: Because the last sentence in the very readable article by Captain Gilland on breakwater earthen core in your issue of Sept. 2 can be misunderstood, this comment is offered.

Nothing unique was contributed by me. Earth had been used in dikes and dams for centuries. Nature made breakwaters wholly of sand in the peninsulas between bays and ocean. Where gravel and cobbles were available the section is smaller, as at Ballast Point, San Diego Bay.

A narrow core of sand alone with quite steep slopes, if armored against wash, is safe under balanced water pressures; but in event of storm, making water average materially higher on the weather side, the induced slow flow within the sand would cause it to run on gentle slope through the voids usual in stone armor, as occurred at Buffalo thirty odd years ago.

Conceivably the armor voids could be made small enough to prevent escape of sand, as was done at Coronado where quarry-run stone was supplemented by gravel; but such success could not be insured everywhere in breakwater construction with floating plant.

The desired dredging, being of both sand and clay, suggested protecting the one by the other; but, as some clays here are treacherous, fears arose. The clay portion of the dredging project, however, was highly arenaceous and of low colloidial content, and consequently able to support unbalanced loads of several tons per square foot without actual flowing.

To help answer questions I made the earlier experiments; but they were crude and unwitnessed. Later more acceptable ones were made by the San Francisco division office; and others, more direct, were made by Mr. McOuat, Lt. Trower and Major Lanagan, mostly after I had been superannuated.

It may be added that comparative estimate of cost in the article does not note that the breakwater as built is somewhat larger than the typical outline on which various estimates were made; nor that the advance estimates made in the district were on the assumption of a single contract instead of six.

Also that to deposit dredgings on the seaward slope of the old San Pedro breakwater, mentioned in the article, used to be disfavored, and permits denied; because the prevailing seas would drive some of the material through the breakwater, as at Cabrillo Beach; and another part around the breakwater end, as at Santa Barbara, necessitating redredging. Moreover the remaining material, shoaling the depth just outside, would cause the seas to become more menacing to the breakwater, and to send more water over the top. Furthermore, no suction dredge, available here, could have excavated all the project area, parts of which are difficult to a 23-ton bucket.

The earthen core has no advantages, except cheapening, and possibly saving of time; and is not to be advocated without consideration of the character of materials.

San Pedro, Calif. D. E. HUGHES.
Sept. 11, 1937

[The change of the word "early" to read "all" in the last sentence of Capt. Gilland's article was due to an error in retyping his manuscript. Gilland has called our attention to an omission that modified a comparison he made. On page 400, under the heading "Economy of the composite type," the first sentence should read: "At the time the original report on the project was submitted (1930) it was estimated that a detached breakwater built entirely of rock, with a sea slope of 1 on 1.5 and a harbor slope of 1 on 1.25 would cost *$10,430,000 and that a composite type with the same slopes would cost* about $7,000,000." The words in *italic* were omitted. —EDITORS]

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OCTOBER 28, 1937

CHICAGO TRANSIT PLANNING has in the past cost $5,000,000 for surveys and expert advice but never until now has the city had presented to it for consideration a comprehensive plan for coordinated surface and rapid transit systems. Last week such a plan came from Mayor Kelly's office. It was devised by engineers in the employ of the city and not by private interests, although the latter cooperated in the present work. Heretofore all surveys and reports have started from the financial and separate-ownership standpoint. Conservation of investment was the first consideration. This plan starts out with a view to developing a physical plan to serve the transit needs of the city, regardless of ownership. With this basis a logical plan has been produced. The legal and financial talent is called upon to make the engineers' concept a reality. Thus, at last, Chicago has before it a plan that is an engineer's rather than a banker's solution of its transit problem.

Based on Fundamentals

IN DRAFTING the present plan for coordination of Chicago transit facilities an analysis was made of the transit requirements for the whole city. Subsequently the existing surface and elevated lines were studied to determine how best they could be fitted into a coordinated system of surface cars, buses, elevated lines and subways which will also take into consideration the problem of getting individual automobiles and trucks in and out of the center of the city. It is thus not surprising to find existing elevated railways turned into elevated superhighways in the new plan. But aside from the breadth of the engineering approach to the problem the most heartening feature of the present proposal is that financing the work appears to be within reach even with the combining and rearranging of privately owned facilities that is proposed. This is due in part to the fact that some of the companies have operated for years without franchise under direction of the courts. Thus the city and courts hold the whip hand and are of a mind to get action, particularly to force the merging of separate companies into a corporate entity. Those are good omens for an early start on a solution of Chicago's transit problem. Whether the ultimate plan resembles the present one is unimportant; the important thing is that the present proposal finds its origin in fundamentals on which any transit plan must be based if it is to be satisfactory.

River Cleanup Programs

FOR MORE than a century and a half Rutgers College students have been singing of the beauties "on the banks of the old Raritan." But pollution from rapidly expanding communities and industries has made these beauties more of a fable than a fact during the last two decades. Now, however, as a result of the river cleanup program reported on p. 717 of this issue, the beauty and utility of New Jersey's largest intrastate waterway will be restored. Behind this story are long-time efforts sponsored by an aggressive state health department, furthered by enlightened community leaders, and financed in part with federal funds. The Raritan River cleanup is an example of scores of similar programs that are in various stages of promotion throughout the country.

Tests Take to the Field

TEST CONTROL of roadbuilding is so common that it is easy to forget how vital an element it has become. In recent years the work of the engineer of tests has gone far outside the laboratory to inspection of materials in the quarries and pits, to surveys of the soils under the road, and to the installation of job laboratories on individual surfacing operations The testing engineer is no longer wholly a housed worker manipulating retorts, scales and testing machines; he goes into the field with the construction engineer and contractor and helps to build the road, taking his testing devices with him and adding research studies to his control testing. In the Texas bituminous roadwork described in this issue we have an example of the field laboratory worker's important place in the operations of the constructor. The value of the returns in this case are attested to by the construction engineer. Quick changes were possible as the work demanded them and errors were discovered before they became hazards.

Contractors' Labor Relations

ACTION taken at the Atlantic City meeting of the Associated General Contractors in establishing a department of labor relations within the national organization finally gives general contractors a much-needed national voice in labor affairs. During all its life the association has had to shy away from labor questions because of differing opinions among its widespread membership. Evven as late as last February suggestions for considering labor

relations were howled down in protest at the San Antonio convention, though it was then apparent that the labor problem could not much longer be ignored. Labor relations are essentially a local problem to be worked out by local employer and employee groups. Yet, because of the broad social and economic questions involved, the local problem is interwoven in national affairs. The action taken at Atlantic City recognizes this situation, leaving each local branch and chapter to work out its own agreements or to resist labor organization if it so desires; the headquarters staff is restricted to advisory, correlating and clearing activities.

Better Works Planning

FROM THE TAXPAYER'S standpoint it is obviously important that public-works moneys be expended with wisdom and efficiency. Obviously, too, the first step toward wise and efficient expenditure is budgeting in accordance with a well-considered program of works. At this season of budget-making, therefore, it is timely to think of how public-works programs are drawn up and how they might be improved. A program that is planned prudently and with an eye to both present and future will go far to assure the citizen that his tax dollar produces a hundred cents of value, while a program compiled in the confused and planless way now all too common will be likely to mean poor service and waste of money.

A striking case is presented by our national public works. Whoever takes the trouble to look through the public-works program contained in the annual federal budget will find a model of what to avoid. The budget, he will learn, is put together from a chaotic mass of individual bureau and department requests for appropriations, each based on some interested official's idea of how much his bureau's activity ought to be expanded. It happens that few bureau heads are hampered by undue modesty concerning the importance of their work, and not often are the requests too small. Revision by the budget officials, remote from technical details, is necessarily of limited effect. Of such stuff is the final works program made; it would be strange if it proved to be an efficient or a wise program.

Suppose, however, that all the national construction and engineering operations were brought together in a public-works department under competent, broadminded technical direction: The conditions just sketched could not long survive. An intelligent program of public works would of necessity evolve, and that almost at once. Bureau activities that now are carried on by separate groups out of all contact with each other would be brought into close relationship, and their objectives and plans would quickly coordinate. Estimates of development needs would adjust themselves to a continuing program, replacing the present expediency estimates.

Among the various reasons that argue for the establishment of a public-works department in the federal government, the value of the system in leading to sound works programming claims a leading position. It is the controlling reason, moreover, for joining engineering with construction in the public-works department, since only by centralizing the preliminary planning with the construction planning can the full facts be brought to bear on programs and priority schedules. And finally, since good programming is vital to a sound construction industry, engineers and construction men have a special concern in the matter in addition to their interests as citizens.

Building in Boxes

COMPLETE HOUSING of a building for winter construction described on a following page carries thought back a decade or two when contractors worked with no such easily handled devices as sheets of plywood and portable unit heaters. In fact these two building aids represent the chief advance that engineering has made in complete enclosure of winter construction.

When in 1922 the housing put up for building the Lake Placid Club in a northern New York winter was front-page news for construction journals, the contractor had a rather substantial wood building to construct. Some of the details are worth noting: 3x6-in. wall studs 30 in. apart sheathed outside with 7/8-in. matched boards and inside with tar paper; a board-sheathed roof on timbers carried on braced bents 10 ft. apart of 3 x 4-in. posts. A blower system supplied hot air for heating; 15,000 cu.ft. per min. at 150 deg. delivered through board ducts. This was in no respect the heaviest of the enclosure structures built in that period to protect winter work; Canadian practice presented examples of more sturdy temporary building.

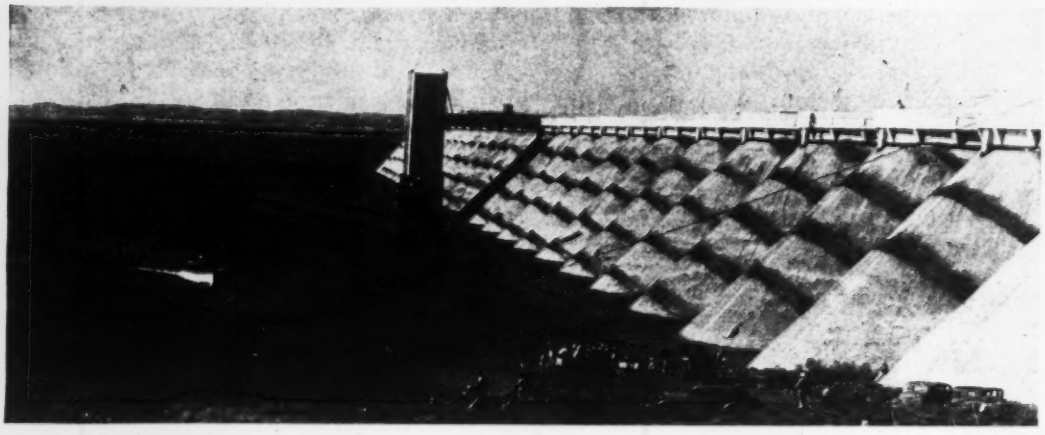
An indication of the Milwaukee building work described in this issue that comes straight down from older experience is that it is not the assumed temperamental characteristics of concrete that gives warrant for the extra precaution of complete enclosure of winter building. Instead, for the buildings of a decade and a half ago, as in Milwaukee last winter, housing was adopted to protect other masonry. It is today as always the laying up of brick and stone and their modern tile substitutes that offers the special hazards of winter construction. Modern cements and concrete-mix design make possible far simpler methods of guarding against frost in concrete construction.

PICTURES IN THE NEWS

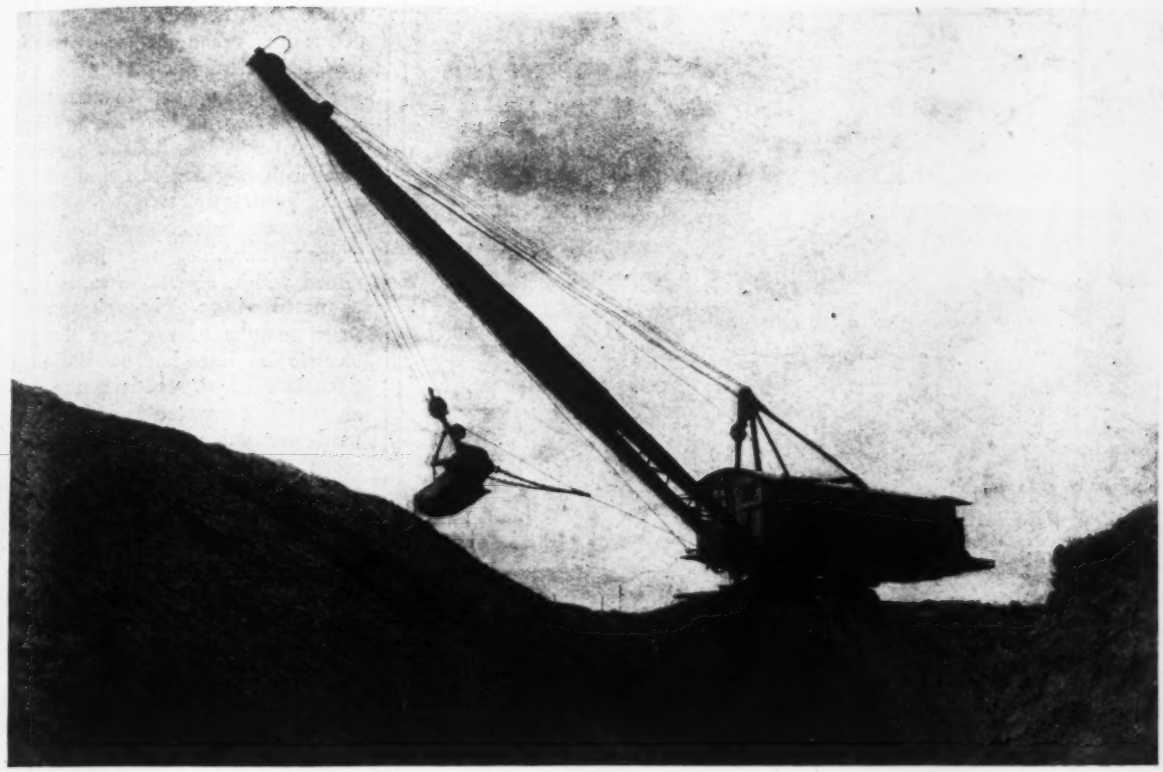
Wide World Photo

MOST MODERN CHAIN BRIDGE. *The dedication of Vienna's new national bridge over the Vienna Danube. It is the third largest chain bridge in the world, containing 15,400 tons of steel.*

MORE GAS FOR SYRACUSE. *(right) Twelve miles of line pipe being laid between the new Woodhull gas field in Steuben County, N. Y., and the point where it joins a line to Syracuse in Tioga County, Pa. This line, finished early this month, is here being bent to the ditch line.*



BUCHANAN DAM DEDICATED. *Ceremonies dedicating the Buchanan flood control and power dam on the Colorado River, about 40 miles above Austin, Texas, were held October 16. The Buchanan Dam has a length of 11,000 ft. and a height of 140 ft. It will impound one million acre-feet of water. The general contractor was the Fegels Construction Co. of Minneapolis.*



LARGE ELECTRIC SHOVELS HAVE CUT GRADING COSTS ON THE CASPER CANAL

Casper Canal Progress

Low cost figures on grading have been established by four large electric draglines on the 59-mile canal of the Kendrick project in Wyoming

EXCAVATION of the 59-mile Casper Canal of the Kendrick irrigation project in Wyoming (formerly the Casper-Alcova project) is in progress at four points, and the four large electric draglines that the U. S. Bureau of Reclamation is using for the work had finished half the mileage by Aug. 1. The draglines are making exceptional speed at low unit costs since the day-labor engaged on the project is employed on an efficiency basis and supervision is close.

Nine siphons across draws, and six tunnels through ridges are the largest of the 150 structures along the canal which include culverts, bridges, turnouts, checks, wasteways, transitions and lined canal sections. One siphon has been finished and three others are 75, 50, and 25 per cent completed, respectively. Two tunnels are completely excavated and two are partially excavated. One is being lined. Methods of procedure on tunnels, siphons and canal grading on the work now in progress are essentially the same as those described in *ENR*, Sept. 19, 1935, p. 385. This article presents recent results of dragline operation, methods used in driving and lining a typical tunnel through shale, and data on aggregate procurement on a batch-weighed basis for the relatively small amounts of concrete required for the numerous structures spread over such a long distance.

Three large (2 to 3-yd.) and one smaller (1½ to 2-yd.) electric draglines constitute the main units in the excavating fleet operated by the government forces. Typical excavation is as follows: The smaller dragline, equipped with a 62-ft. boom, started last year in May at mile 33.7 where the center cut varied from 45 to 25 ft. The extreme depth of cut of the excavation necessitated a waste pit 25 ft. wide on the bottom and 130 ft. from the center line of the canal. Three 25-ft. cuts were excavated from the canal to the pit, building it up 20 to 30 ft. above the natural ground surface. The remaining 20 ft. was excavated with the machine in the bottom of the canal casting to waste piles on either side.

Of the 4,623 hr. that the machine

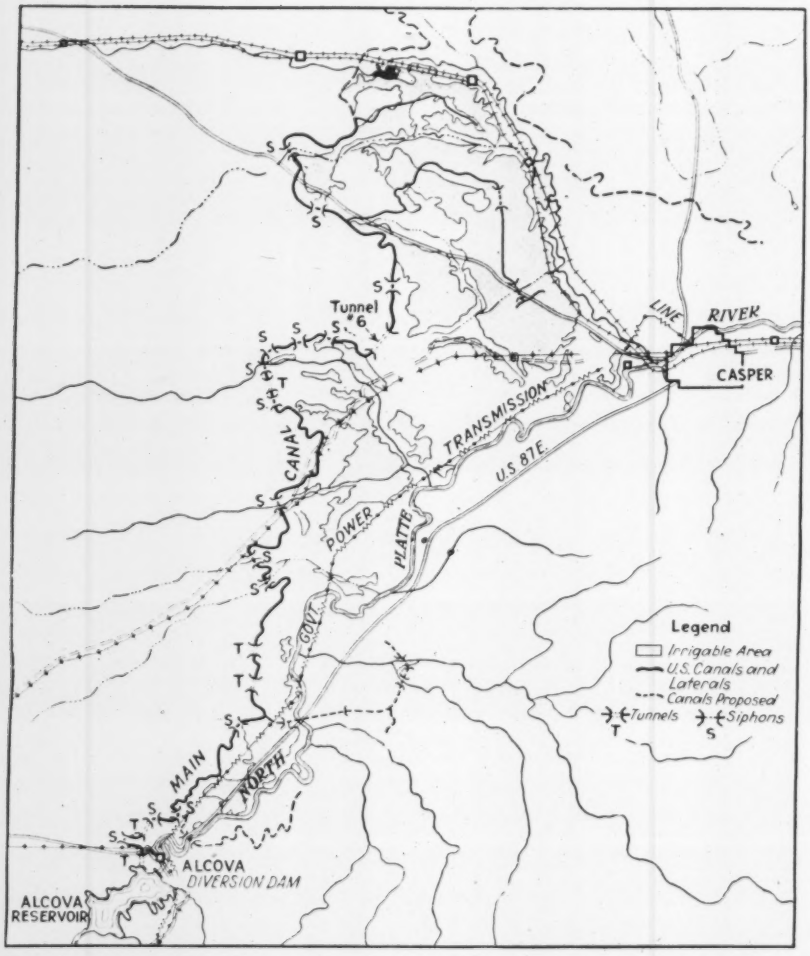


Fig. 2. The canal supplying the Kendrick irrigation project extends 59 miles from Alcova Dam to serve 35,000 acres of land east of Casper, Wyo.

doing the grading operated last year the crews were actually digging 85.1 per cent of the time. Cost of excavating nearly 500,000 cu.yd. was 7.27 c. per yard including all operating costs, depreciation, transportation of crews and electric power at 0.73 c. per yard.

Two of the larger draglines with 2 and 3-yd. buckets and 74 and 80-ft. booms were started in opposite directions from mile 23.1. One machine encountered shale and sandstone that had to be blasted but turned in a cost record of 8.79 c. per yard, which included the cost of 0.454 lb. per yard of dynamite used for the 60,000 cu.yd. of rock. Excavation amounted to 433,000 yd. and rehandling 128,000 yd. Actual digging time was 89.4 per cent of the 4,289 hr. the crew worked. Large swings in skirting the rise of a series of low hills and a large amount of borrow and skimming for corebank material for the second machine, in addition to shutdowns due to repairs, cut the digging time to 74 per cent of the 4,190 hr. the operators worked. The operators spent 23.6 per cent of their time on repairs. Costs however were 6.45 c. per cubic yard at the end of October jumping only to 6.83 c. at the end of the year.

The third large machine went to work June 1, 1936 at mile 3.6 and had dug downstream four miles by the end of the year through 10 and 20-ft. sidehill cuts of hard shale overlaid with 15 ft. of gravel and water-worn boulders. Stripping of the gravel, moving back to excavate the blasted shale brought the moving time to 5.2 per cent of the total operating time.

Trouble with one of the 3-yd. buckets due to failure of the top arch caused some delays. However, 571,000 yd. of excavation and 10,000 yd. of rehandling was removed in 4,189 hr. of operators time, 91.4 per cent being spent in actual digging, moving and repairing track. The unit cost was 6.23 c. per cubic yard including a power cost of 9.68 c. per yard.

This year unit costs on these large capacity machines have been maintained within about the same limits as noted above. Through the first seven months of the year the four electric draglines had handled about 2,000,000 cu.yd. which is the same amount as excavated in 1936. Power used per cubic yard during these seven months varied from 0.36 kw. to 0.44 kw. and averaged 0.41. At $1\frac{3}{4}$ c. per kw. the cost is 0.72 c. per yard. The average yardage per 8-hr. shift moved per machine was 1,105 yd. varying from 893 yd. in January to 1,170 yd. in March. These machines are being operated a maximum of 21 hr. per day by using fourteen operators on the four units and each operator being limited to 40 hr. per week.

Electricity for these machines is furnished by a temporary high tension transmission line from Casper to four substations located at miles 7.9, 17.8, 28.2 and 39.1. The system followed has been to construct the lines on the upper side of the canal and from five to seven miles in each direction along the canal from a centrally located substation. When the machines have completed operations in any section the lines are dismantled and then rebuilt on the other side of the substation as excavation progresses.

For miscellaneous operations the government has two crawler tractors, one gasoline-driven tractor with a winch, one road grader and one tractor with angledozing trail builder. These units have recently been supplemented by a diesel-powered 95-hp. tractor equipped with angledozer and a double-drum power control unit and 4-yd. scraper. Bond plowing was done with two heavy breaking plows drawn by the tractors on all portions of the canal where the natural surface is below the maximum high water surface in the canal. Eight furrows are plowed for each canal bank. Tractors, graders and bulldozers last year built 15 miles of service roads along the high tension line and 66 miles of canal service roads. They also repaired and

bladed 41 miles of stock trail roads. In the winter one tractor was kept busy on snow removal.

Tunnels

Tunnels 3, 4, 5 and 6 are being constructed by contract with W. E. Callahan and Gunther & Shirley Co. Typical of the tunnel excavation was the following procedure on No. 6 which is a horseshoe section, 13 ft. 9 in. high and 5,460 ft. long, driven mostly through shale.

The bore was started at the outlet portal last May and is now being lined. Drilling was done from a M.W.D. drill carriage having two side wings which were raised to a horizontal position by air when the jumbo was in position for timbering or drilling. The drilling jumbo carried all the posts and bars necessary for the mounting in any desired position of five automatic feed drifter drills. One of the machines was located in the top center, one on each side and two in the bottom. Air was supplied from the power house through a 5-in. welded pipeline, the connection to the jumbo being 50-ft. 3-in. bull hose. Water for drilling was supplied from a 900-gal. tank mounted on a truck and coupled to the drill carriage. The tank was taken out after each drillout and refilled for the following round. A 1¼-in. drill steel was used with detachable bits.

The usual procedure and time for each drillout operation for the month of July is broken down and listed below:

	Hours	*Per Cent*
Setup	20	3.0
Drilling	165	24.6
Blowout and shoot	45	6.7
Ventilation	33	4.9
Mucking	269	40.0
Delays	19	2.8
Timbering	121	18.0
	672	100.0

The number of holes drilled per round and the length of the rounds depended upon the ground. When the ground was bad 7-ft. rounds were drilled, breaking only enough ground for one set of timber. In this kind of ground it was often necessary to crown-bar both on top and on the sides. At other times 12-ft. rounds were drilled and shot.

A 30 or 40 per cent powder was used throughout the job, the total being 132,100 lb., not including that used in trimming and in the invert. A total of 25,337 caps was used for tunnel excavation.

Muckers loaded 4-yd. cars and three 5-ton battery locomotives were used for hauling and inside switching. During the latter part of the job the long haul from the heading to the dump caused such a heavy drag on the batteries of the locomotive that a 4-cylinder gas motor was used to take the muck trains from the portal to the dump and return. A noticeable saving in mucking time was made by this procedure.

Sixty-pound rails were used in the tunnel and on the dump. One passing track was put in and a California switch was used for passing cars at the heading.

Timbering was required in 94 per cent of the tunnel, the untimbered section being in sandstone. Timbering was done by the heading crew and was set from the drill carriage when moved to the heading for drilling. Some 853 permanent 12½-lb. steel I-beam tunnel supports were spaced as required from 3 to 12 ft. apart. For lagging and blocking 837,000 ft. of timber was used.

Ventilation was furnished by a blower which forced the air to the face through a 20-in. ventube.

Water was encountered throughout the entire length of the tunnel, not enough to require any elaborate plans for disposing of it, still enough to make underfoot conditions unsatisfactory. Two large pumps, one air and the other electric, were installed permanently at small sumps and portable air pumps were used to dewater the low places in the tunnel.

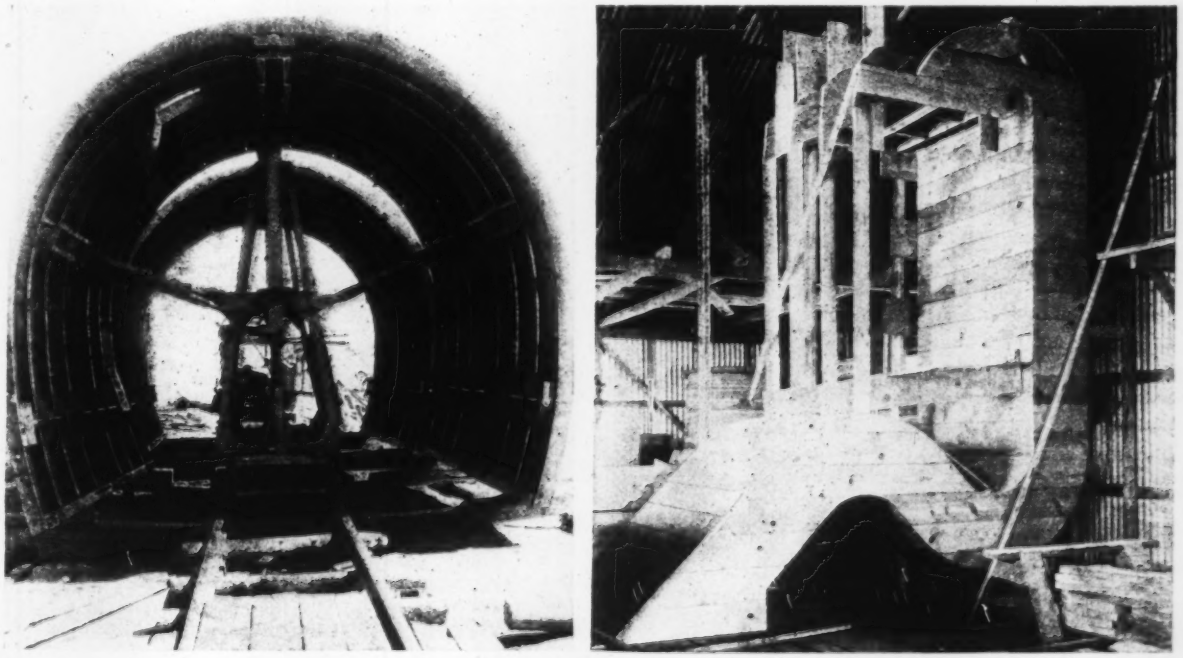


Fig. 3. Jumbo for the steel forms used in canal lining, and at the right, a form for a siphon spillway set up in the Casper shop.

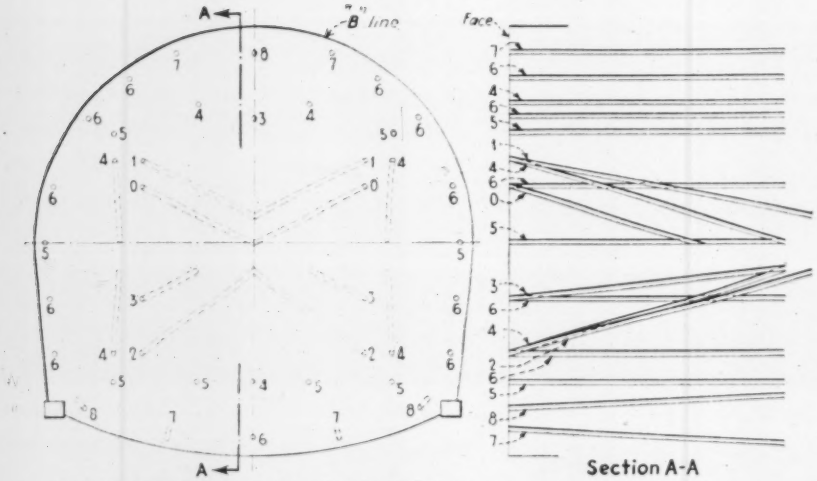

A
"B" line
Face
A
Section A-A
10 ft. 42 hole drill rd. used at tunnel No. 6. Ave 75 yd.,
200 - 225 lb. powder
2-0 delay 3-3 delay 11-6 delay
2-1 " 7-4 " 4-7 "
2-2 " 8-5 " 3-8 "

Fig. 4. Drill-hole arrangement used in driving Tunnel No. 6.

The rapid disintegration of the black shale, which predominated throughout the tunnel, when exposed to the water and air, made it almost impossible to keep the drain ditches open. The pumps discharged into a 3-in. water line which in turn discharged into the drainage ditch above the portal. Approximately 100 g.p.m. was pumped from the tunnel.

An electric mucker, powered by a 50-hp. motor, was used for invert excavation. Most of the invert was shot to grade requiring very little additional shooting.

Diesel equipment was installed for the generation of electric power, the two generators developing 100 hp. for charging the locomotive batteries, the operations of all equipment and lighting on the job.

Tunnel lining

Lining of Tunnel 6, now in process, is typical of other tunnels. The section requires 2.3 cu. yd. of concrete per lineal foot on the average, of which 1.9 cu. yd. is paid for, the remainder being overbreak. Prior to concreting sufficient lagging is removed to permit concrete to enter the overbreak space back of the sheeting. Some 150 ft. of collapsible steel forms is used. These forms are in 15-ft. sections hinged at the top and 32-in. from the invert to permit pulling the bottom curtains to a horizontal position. The lifting carriage is mounted on a track on the invert, which was placed first. Vertical jacks on the carriage lift a strongback which engages the top hinge taking the full weight of the form and lowering it about 12 in. after the bottom struts across the invert have released the bottom of the form and the curtains have been lifted. The carriage then moves forward to a new position ahead of the last poured section. The 15-ft. sections, which are really two 7½ ft. sections bolted together, have eight openings, four on the sides and four on the top, to permit entrance of workmen using spade tampers. Three tampers on each side are employed.

Concrete is mixed in the tunnel adjacent to the last empty form in a 1-yd. mixer mounted over a concrete pumping assembly discharging through a 7-in. pipe, 85 ft. long, extended in the arch crown back to the point of deposition. This pipe, the end of which is always buried 10 to 15 ft. in the issuing concrete, is withdrawn by movement away from the forms of the whole setup. Air under 100-lb. pressure is let into the pipe 20 ft. ahead of the discharge end. The valve on the air line is cracked to let air in continuously to keep the concrete moving. This procedure is considered more effective than letting air in intermittently behind slugs every four or five strokes of the pump.

Batched aggregate is brought to the mixer in three-car trains by battery locomotives. Each car has three 1-yd. compartments and is dumped endwise into the mixer hopper by dumping equipment on the mixer plant lifting the body from center trunnions and tipping it into the mixer skip, the compartment partitions being released after each mix.

The long haul to the far end of the mile-long tunnel was the bottleneck in the operation when the work started. Progress was 45 ft. (three sections) per shift of 8-hr., with occasional 60-ft. pours. Speed of the

Fig. 5. Batch weighing hoppers, mounted on skids, are pulled to within loading range by the draglines that load them.

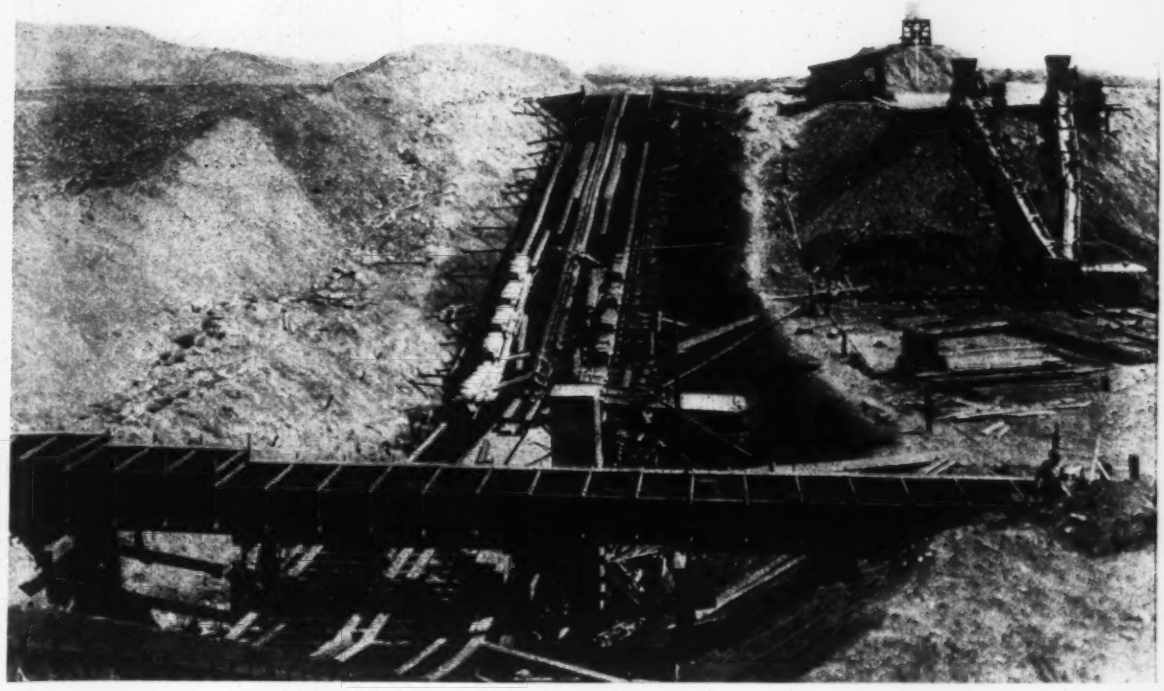


Fig. 6. Siphons carry the canal under major cross-drainage channels. Note the concrete plant at the right made up of two mobile mixers serving a concrete pump on the lower level.

locomotive was 7 m.p.h. Batteries in this heavy service needed replacement for recharge twice every shift. The battery in the service locomotive at the mixer switching cars last twice as long as in the hauling unit.

A 110-ton batching plant is built on one side of the canal slope near the inlet portal so that all materials are gravity fed through the aggregate bins into which trucks dump at the top. Aggregate is stocked nearby where the trucks are loaded by a mechanical loader. Cement bags slide down a metal-lined chute to a 2-car storage space at the charging floor level. A weighing batcher with scales proportions the aggregate.

Early in June white encrustations were noticed forming on the damp exposed surface of the tunnel. Two laboratories reported that the water, although not the best, could be used for mixing concrete. The analysis shows a rather high percentage of solids and sulphates. The report of the field laboratory, relative to the physical effects on concrete, indicated that after a partial submergence of the cylinders in this water for a period of six months, a very noticeable spalling had taken place along the water line. Further investigations in the Denver Laboratory of the Bureau of Reclamation justified the use of a sulphate resistant cement. Accelerated tests also made in the Denver laboratory indicate that the sulphate resistant cement is relatively five or six times more resistant that a modified cement and that the latter is three times as resistant as standard cement.

On larger units, such as siphons, where a pumped concrete is used, two of the small mixers are set up in parallel to feed into the pump hopper. The quantities required in the nine siphons vary from 600 to 1,300 cu. yd. of concrete, heavily reinforced with 150 lb. of steel per yard. The siphon concrete is vibrated with power furnished to the vibrators from two small power units mounted on auto wheel trailers. The smaller one can care for two vibrators and the larger for four or five.

All aggregate for the structures on the canal has to be hauled from five pits on the North Platte River distances up to 10 miles. These pits were located after an exhaustive survey of available deposits with consideration given to depth of stripping and occurrence of small material, since all deposits contained an excess of fines. Since it was desired to have uniform concrete and proportion it by weight, a scheme of batching at the pit and delivering it directly to the mixers was worked out. If stocked at the structures wastage would have been high and measurement by weight practically impossible.

With the exception of aggregate for the tunnel lining furnished by the tunnel contractor, contracts were let for stripping, excavating, screening and stockpiling of sand and two sizes of gravel in parallel windrows for the remaining structures. Separate contracts were made for trucking on an hourly basis since the material was all batched by weight at the pits and hauled as needed to small mixers at the various structures. Since the successful bidder, Mountain States Co., Billings, Mont., had prepared aggregate for the Alcova Dam structures he moved the equipment at the dam down to the successive pits.

Three 3-compartment gravity bins furnished with hopper weighing scales were purchased by the government to batch the aggregate into trucks at the pits. The bins are mounted on skids riding on rails over 12x12-in. timbers so that they can be skidded toward the stock piles as the ¾-yd. loading dragline progresses. A cable around the col-

umns provides a hitch for the dragline to skid the bins along, a hinged 6x6-in. strut being placed between the rail tracks to keep them from pulling together. Owing to the isolation of the pits all small movable parts are put away under lock and key when the bins are not in operation. The glass covered scale face is provided with a welded sheet steel "shroud" to protect it from the weather and shotgun enthusiasts. To direct material into the narrow batch compartments in the trucks sheet-iron curtains 8 in. wide are hinged on rods supported below the leaves of the discharging gate. These curtains swing clear of the top of the truck and partitions as the latter moves along.

Once located, careful time schedules for each pit are made up to govern the operation of the hauling trucks since no storage piles are made at the structures, the trucks delivering directly into the mixers. In consequence it was necessary to time the truck arrivals so as to supply aggregate at the rate at which concrete is needed at the structures. Six mixers, three of 10-cu. ft. and three of 7-cu. ft. capacity are provided and moved from job to job, the small size requiring 10-cu. ft. compartments in the trucks. The timing schedule for the number and dispatch of trucks was made up for single mile distances up to 12 miles between gravel pits and structures. The basis of the schedule was 15-m.p.h. travel speed loaded, 20 m.p.h. empty, 7½ min. to load and 15 min. to unload. With these figures the total round trip time is estimated and the number of trucks for continuous operation of the mixer is ascertained and set down in a table. Concreting crews start shift at 7 a.m. and the first truck is required to be at the mixer at that time. Trucks and drivers cost $2.25 per hour.

The Casper Canal is being constructed by the U. S. Bureau of Reclamation with John C. Page as commissioner of reclamation. All engineering and construction of the bureau is supervised by R. F. Walter, chief engineer, and J. L. Savage, chief designing engineer, located at Denver, Colo. H. W. Bashore, with headquarters at Casper, is construction engineer for the Kendrick Project, and J. J. Matthews, with offices in Casper, is resident engineer of the canal division.

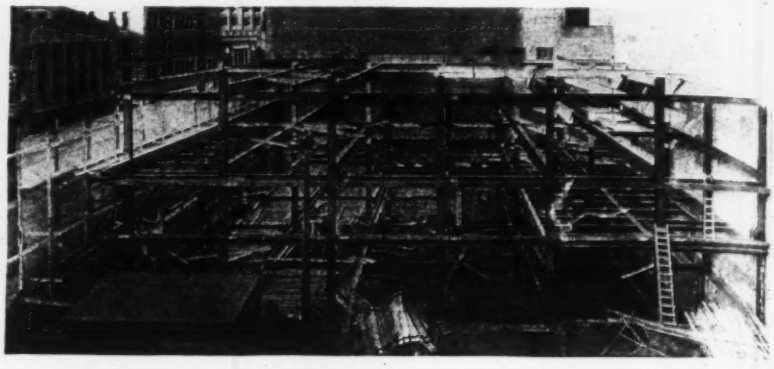


FIG. I. A BUILDING GETS A WINTER OVERCOAT

Building in a Box

Milwaukee contractor incloses glass-walled structure in plywood sheathing for winter construction

Icy blasts from Lake Michigan didn't stop a Milwaukee contractor from going ahead with a rush building job last winter, even though the exterior walls of the structure were entirely of glass tile, the application of which is decidedly not a cold-weather operation. However, the contractor made the whole job, excepting steel erection, a normal-weather one by inclosing the entire structure within a box of plywood with a canvas roof. Steam unit heaters kept the interior at a comfortable working temperature.

The job was a two-story mercantile building for the Plankinton Trust at West Wisconsin Ave. and North Second St. in the heart of downtown Milwaukee. The building, 84x100 ft. in plan, was to be occupied by a restaurant utilizing the basement and west half of the first floor, and a high-class women's apparel shop occupying the east half and corner and the entire second floor. The architecture is modernistic with a colored glass tile exterior. Steel columns and floor beams, concrete floors and brick walls make up the structure. The building costs about $225,000, including complete air conditioning.

The site was ready for steel on Dec. 1, and three weeks later the simple steel frame was complete. All steel was erected by a single stiffleg steel derrick set up on the basement floor. Before the steelwork was finished, the contractor had started the wooden box that was to inclose the building.

The frame of the box consisted of two-post bents of 4x4-in. timbers, set normal to the face of the building with the inside post 2 ft. out from the building line. The bents were spaced at 8-ft. intervals; the two posts in each bent were 5 ft. apart. Horizontal members on the outside of the frame were set at 1-ft. elevations; cross and inside members at 6-ft. vertical spacing. The cross members extended beyond the inside line of posts to the building line to act as supports for scaffolding for the exterior walls.

The outside face of the double frame was sheeted tight with 9,000 sq.ft. of ⅜-in. plywood in 4x8-ft. panels. No diagonal bracing was required, for the plywood sheets provided sufficient rigidity to the frame. The wooden inclosure was required on the two street sides of the building only, as existing higher buildings adjacent to the other two sides completed the inclosure. A canvas roof closed in the top.

The utilization of the inclosure frame as a scaffold resulted in a cost saving that almost paid for its installation. In calling for subcontractor bids on the setting of the

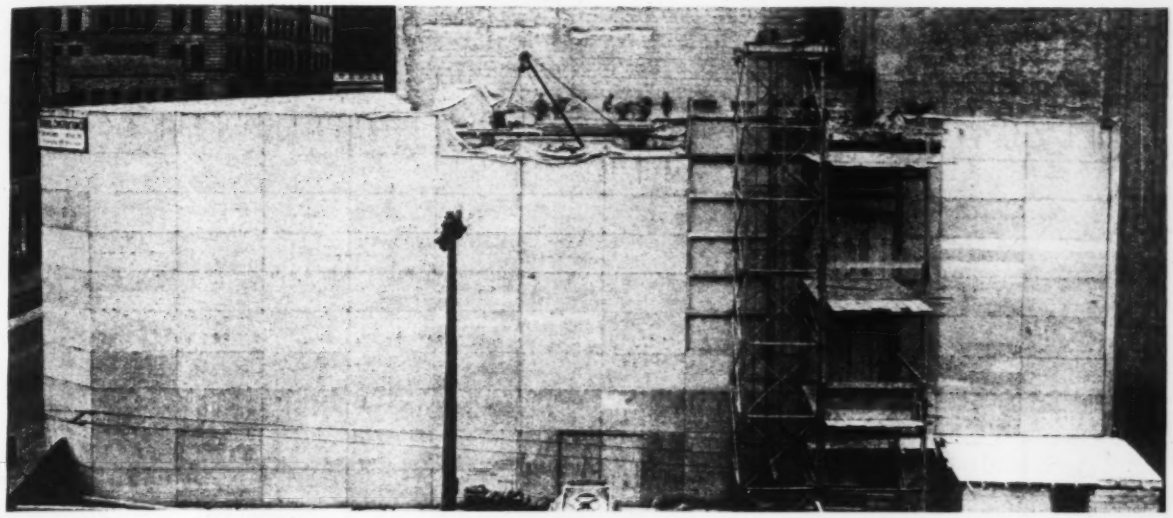


Fig. 2. Inside of walls of tight sheeting and under a canvas roof construction operations go on uninterrupted by winter weather. Five steam unit heaters maintain comfortable working temperatures.

Fig. 3. When the building shed its wooden skin this modernistic structure was revealed. Fast winter construction permitted occupancy of the building early in the spring.

glass tile the general contractor specified that he would furnish the scaffolding. Consequently, the glass bids were much less than they would have been otherwise.

Heat for the inclosure was supplied by five steam unit heaters of 700 sq.ft. size each. Steam was supplied from the city municipal steam heating system.

Cost of inclosure

The box inclosure cost $1,600 for labor and material. Allowing a salvage value of $500 for half of the cost of material, the net cost was only $1,100. The bill for steam for the entire job amounted to $700. Installation of the heaters cost $200, and the units were rented for $45 each, or a total rental cost of $225. The rental agreement provided option for buying the heaters, which was taken up by the contractor for this type of unit proved so satisfactory.

The rigid inclosure interfered in no way with construction operations. A tubular steel hoist tower was set up on the North Second St. side, outside of the sheeting, facing landing stages built out at the mezzanine, second floor and roof levels. Sliding doors were installed in the inclosure to serve each platform. Doors were also installed at street level for access to the ground floor. Concrete was ready-mixed, dumped at the foot of the hoist tower from truck to buggies for delivery inside.

Personnel

The structure was built for the Plankinton Trust by the Siesel Construction Co. of Milwaukee. H. W. Buemming, Milwaukee, was the architect. Recognition of the services of both architect and contractor is given by the owner through inscribing their names on a plaque near the corner of the building.

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No-Passing Signs Standardized

ESTABLISHMENT of no-passing zones at points on Indiana highways where curves or grades limit sight distances ahead to less than 750 ft. is made a duty of the State Highway Commission by recent legislation. While many roads are marked the commission has issued instructions which will make the markings uniform: A yellow line is used applied parallel to the black centerline on hills and curves. A 24-in. yellow circle will warn motorists that they are entering a no-passing zone, and they are to remain to the right of the line as long as it persists. On three-lane highways the yellow circle and line will guide the driver into the outside lane until there is again sufficient sight distance ahead to permit passing.

FIG. 1. TEXAS TRUNK ROAD OF ASPHALTIC CONCRETE HAS GRAVEL SHOULDERS A FULL LANE IN WIDTH

A Supermechanized Black-Top Job

by HORACE S. KERR
Texas State Highway Department, San Antonio, Tex.

New Texas trunk highway exemplifies black-base asphalt road-building in its most advanced development

ASPHALT ROAD DESIGN and construction of noteworthy character is exemplified by the new section of trunk highway from San Antonio north about 25 mi. to Bourne, Texas. The traffic importance of the road will be noted later but here it is of primary interest that the newly-built section represents a high order of modern flexible-base asphalt road surfacing built by the most modern processes. Laboratory control and mechanization of construction are outstanding elements of the improvement.

Structure and materials

The 25.1-mi. section of road being considered is shown by Fig. 2. The grading, drainage structures and sub-base were completed in 1934 and in the grading use was made of the caliche and of the limestone rock taken from cuts to construct a sub-base. This sub-base, 40 ft. wide, consists of 9 in. of compacted caliche and 3 in. of compacted crushed-limestone, making a total compacted depth of 12 in.

So that the road might be of immediate service the sub-base was given an application of about 0.4 gal. per sq. yd. of medium-curing cut-back asphalt which penetrated about ½ in. and produced a thin surface mat. This mat stabilized the surface of the sub-base and was a dust preventive during the few months intervening between the completion of the grading work and the beginning of the pavement construction.

The pavement consisted of an asphaltic-concrete base of 3 in. compacted depth, with an asphaltic-concrete surface of 1½ in. compacted depth, making a total depth of 4½ in. In the immediate vicinity of San Antonio the pavement is 40 ft. wide, while the remainder is 20 ft. wide with 10 ft. of crushed rock on each side (Fig. 3). These crushed-stone shoulders are desirable as refuge areas for present traffic and will provide seasoned bases for future pavement widening when traffic demands a four-lane pavement the full length of the project.

The paving was started on Aug. 28, 1935 and completed on March 12, 1936. During this period 50,522 tons of asphaltic concrete base and 23,578 tons of asphaltic concrete surface, a total of 74,100 tons, were placed. The area of completed pavement is 313,945 sq. yd.

Commercial stone quarries were in operation adjacent to the highway and near the center of the project, a very economical location for the aggregate supply. All aggregates and mineral filler were secured from this source, except a very small amount of fine silica sand, which was secured a few miles south of San Antonio. The limestone was of medium hardness, having a percent of wear of 5 to 8.

The asphalt cement was an oil asphalt of 55 penetration and was refined from a Mexican crude. During the past few years there has been some difference in opinion as to the grade of asphalt cement that should be used in this type of pavement. The tendency at this time seems to favor an asphalt of higher penetration than has commonly been used. Through the cooperation of the state, the con-

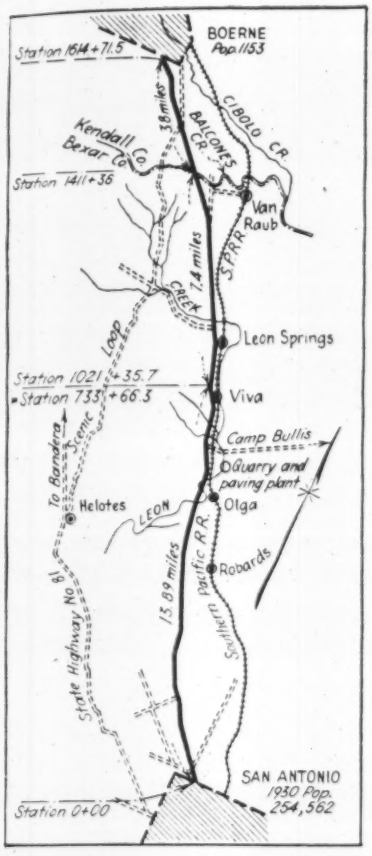

Fig. 2. New asphaltic concrete road running north out of San Antonio, Texas.

tractor and the asphalt producers, The Texas Co., two cars of asphalt cement of 90-penetration were used so as to have a comparison of the 55-penetration with the 90-penetration.

The paving mixtures consisted of coarse aggregate, fine aggregate, mineral filler and asphalt cement in about the following proportions:

	Per Cent
Asphaltic Concrete Base:	
Coarse aggregate (Max. size 2 in.)	73
Fine aggregate (No. 10 sieve down)	22.7
Asphalt cement (55-penetration)	4.3
Asphaltic Concrete Surface Course:	
Coarse aggregate (Max. size 1 in.)	64
Fine aggregate (No. 10 to 200)	27
Mineral filler (Pass. 200)	4.1
Asphalt cement (55-penetration)	4.9

Mechanical pavers were used to place the mixture on the road and there was no segregation of material which prevented the accumulation of the larger stone on the surface that is common in hand-placed jobs. The lack of this excess of large aggregate naturally gave a fairly closed surface texture; in fact it was closed more than was desired for a base course, and a larger percentage of coarse aggregate would have been used in the base-course mixture had the specification requirements not prevented it. The surface texture of the surface course was open enough to be non-skid.

Machine operation throughout

The paving plant was set up at the stone quarry, in such a position that the crushed aggregate could be fed direct from the crusher to the plant stock piles, by a belt conveyor system. The existing railroad connections to the commercial crushing plant were available for delivery of the asphalt and the quarry was near the center of the project so that an economical haul of the pavement mixture from the plant to the road was had.

The plant consisted of a feeder system for the aggregates, a dryer, the screening and storage-bin units, the asphalt-heating and supply system, the dust collector and mineral-filler units, the weighing and batching units, and the 5,000-lb. capacity twin-pug-mill mixer. The plant was new throughout and was electrically powered and operated and equipped with a self-recording pyrometer for recording the temperature of the aggregates and the asphalt at all times.

A feature of the plant worthy of mention was the limited storage for the hot aggregates; the capacity of the hot aggregate storage bins was limited to two batches. It was therefore necessary that the cold aggregates be taken from the stock piles and fed to the dryer at a uniform and constant rate and this was accomplished by automatic feeders on the cold-stone bins.

The plant operated 76 per cent of the available working hours, or 871 hr. and 35 min., from the first batch to the last batch mixed. The average output per hour operated was 85 tons; the maximum hourly output was 123.8 tons, and the maximum daily output was 1103.9 tons in 10 hr. and 10 min. The mixer was equipped with an automatic locking device and all materials were in the mixer a minimum mixing time of 45 sec. per 4,000-lb. batch.

Two Adnun asphalt pavers (Fig. 4) placed the paving mixtures on the road with many advantages over hand methods. The material was placed without undue segregation, which provided a very uniform distribution (Fig. 6) of the aggregate from the top to the bottom of the pavement and this uniformity reduced the amount of internal voids, and permitted the use of a higher percentage of coarse aggregate and a lower percentage of asphalt than would have been required for mixtures laid and raked by hand. The riding surface obtained by the pavers was also far superior to surfaces obtained by hand raking. The surface texture was very uniform in appearance. A more desirable surface as to both smoothness and texture was obtained when the machine was kept in a continuous forward motion.

The rolling was done with three 10-ton three-wheel rollers, one being equipped with a roll-a-plane attachment, and two 8-ton tandem rollers.

The usual procedure was to place asphaltic base for two days and then the asphaltic surface for one day.

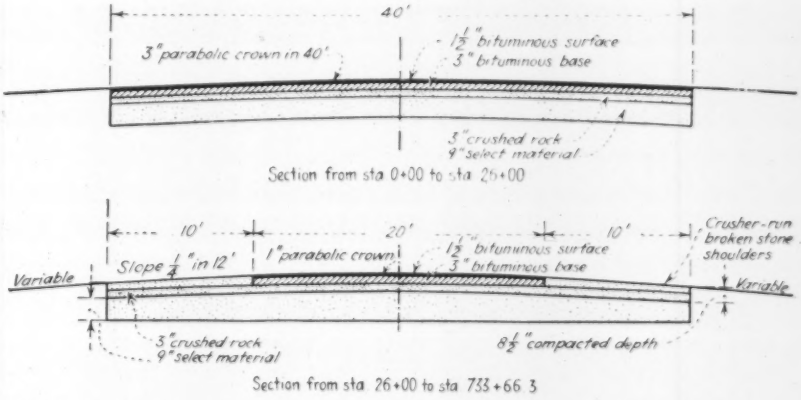

Fig. 3. Four- and two-lane construction on the new trunk road out of San Antonio.

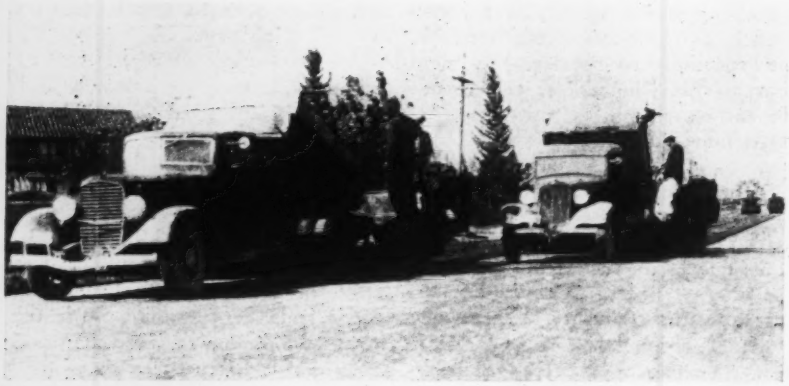

Fig. 4. Two machine pavers laid and spread the asphaltic base and top courses.

Fig. 5. Checking forms and sub-base prior to placing the crushed stone shoulders.

This procedure insured a full-day's run of the surface course so as to avoid a type change during the day. Under normal conditions the surface course bonded to the base course without the use of a tack coat to such an extent that on taking sections from the completed pavement, it was impossible to detect a joint between the two courses (Fig. 6).

The unit price for the base course was $3.58 and for surface course was $3.80 per ton complete in place. The average cost of the asphaltic concrete was about 90c. per sq. yd.

Laboratory kept control

The state maintained a very complete field laboratory at the mixing plant for the design and control of the paving mixtures. Screen analyses were made hourly of the aggregates to check the gradation, and extraction tests were made of both the hot mixture sampled from the truck and samples of the completed pavement. These analyses represented the true proportions of the various ingredients of the pavement actually placed on the road. Samples of the mortar from the paving mixture were made into briquettes and tested on the stability or shear machine. This machine is very valuable to the field inspectors, in determining the type and quality of fine aggregate and mineral filler that will produce the strongest mortar. It was found that different fine aggregates and mineral fillers of like gradation produced mortars of very variable strengths due to the mechanical make-up of the individual grain particles. Screen analysis alone will not detect this difference.

Asphalt cement extracted from the pavement samples was recovered by the Abson method (Fig. 7) and analyzed. It is interesting to note that the penetration of the extracted asphalt was uniformly 10 to 15 points lower than that of the asphalt before it was incorporated in the mix.

In the use of the two cars of 90-penetration asphalt no change was

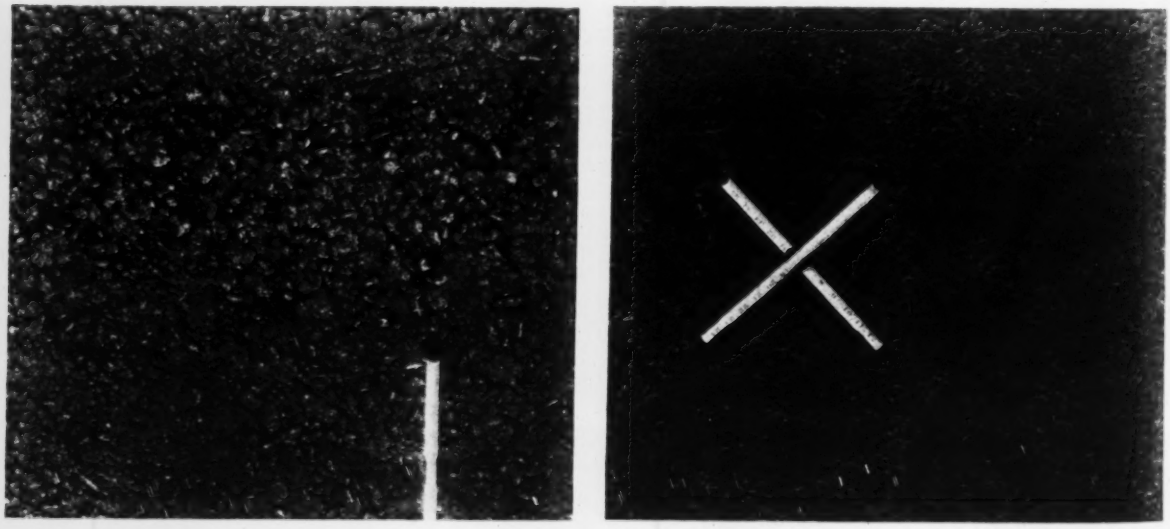

Fig. 6. Textures of surface obtained in base (left) and in surface course (right) of asphaltic concrete.

made in the percentage of any ingredient of the mixture used for the 55-penetration asphalt. The stain test on the 90-penetration mixture gave a heavier stain than for the 55-penetration, and the shear or stability test on the mortar dropped off slightly. These results would indicate that slightly less of 90-penetration could be used, than of 55-penetration. However, the 90-penetration mixture did not appear to be too rich and did not have any tendency to shove under the roller or for the surface to seal over.

In use 1½ years

The pavement has been under traffic for 1½ years at this writing (July, 1937) and there is no visible difference whatever in the 90-penetration pavement and the 55-penetration pavement. It is the writer's opinion that 90-penetration asphalt cement will provide slightly increased flexibility in the pavement structure without danger of shoving, provided, however, that the asphalt cement used is of good quality and the character and amount of mineral filler are proper. Tests made in the field laboratory on this job indicated that the character of the fine aggregate and mineral filler (that material passing the No. 10 sieve) had a much greater influence on the stability of the paving mixture than the change in the penetration of the asphalt cement.

The average penetration of the asphalt extracted from the paving mixture and recovered by the Abson method was 38, while the average penetrations made daily on samples of asphalt from the storage tanks was 51. During the processing of the paving mixture the penetration of the asphalt dropped 13 points. An explanation may be that when the asphalt surrounds the mineral aggregate particles in a very thin coat some oxidation of the asphalt takes place. However, the cause for the drop in penetration is not of as much significance to the writer as the fact that it has been learned that there is a drop in penetration during the processing of the materials. In the past it was thought that 55-penetration asphalt was had in the pavement structure; instead, the tests showed a penetration of only 35 to 40.

The writer cannot emphasize too greatly the importance of a well-equipped field laboratory and that the construction and inspection work be supervised by capable well-trained men.

This highway is a part of U. S. Highway No. 87 and serves tourist traffic from the north and northwest going south to the resorts on the Gulf, to the Rio Grande valley and to Mexico, and traffic from the south going north to the hill country of Texas, the Texas Plains and to points out of Texas. The commercial truck traffic has increased very rapidly during the last few years. Wool and mohair from the great sheep- and goat-raising section of the state are trucked to ports on the Gulf; vegetables and fruits from the Rio Grande valley and from the winter garden sections are trucked north—some being trucked to the northern states.

This flow of through traffic together with the local and semi-local traffic demanded a highway that would safely accommodate both the type and amount of traffic.

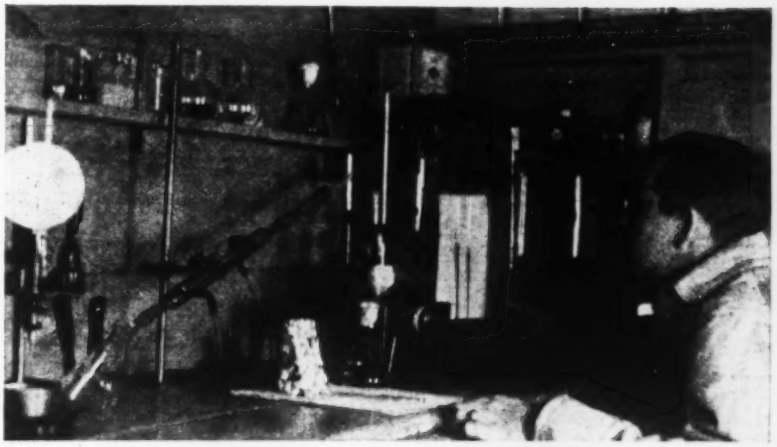

Fig. 7. Part view of the extraction room of laboratory showing apparatus for recovery of extracted asphalt by the Abson method. An asphalt technologist was in charge of the laboratory work.

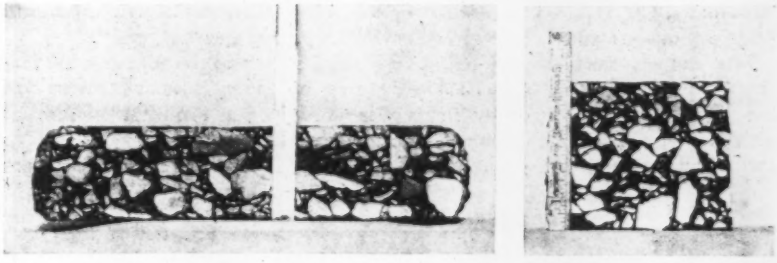

Fig. 8. Specimens cut from pavement show even mix and close bond of top and base; left, section of base, and right, section through base and top.

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Tallmans Island Plant Contracts Under Way

THREE CONTRACTS have been awarded on the Tallmans Island 40 m.g.d. activated sludge plant, New York's newest sewage treatment plant now under construction (*ENR*, Sept. 30, 1937, p. 545). Work on contract No. 1, a $334,780 item covering a bulkhead, pier and outfall sewer, has been completed by J. Rich Steers, Inc.

The North-Eastern Construction Co. holds contract No. 2 which includes the construction of plant structures and installation of equipment at a cost of $1,303,000.

Contract No. 4 totaling $469,000, was awarded to the Worthington Pump & Machinery Co. for engine driven pumps, blowers, and auxiliary machines.

New York Regional Area Shown in Monmouth Model

Model built to scale from topographic maps portrays geographic and culture features in 6700 sq. mi. region

A 2,000-FT. TO THE INCH scale model of the metropolitan region of New York City is now on exhibition at the offices of the Regional Plan Association, 400 Madison Ave. Embracing an area 73 miles east and west and 86 miles north and south it shows the striking geographical and topographical features and their relation to both existing conditions and future growth.

The model, made by WPA, is based on enlargements of the standard U. S. Geological Survey maps with the relief built up by layers of cardboard cut out along the 20-ft. contours and laid out accurately on a network of parallels of latitude and longitude. The surface was then smoothed over with a plastic material which sets up almost as hard as stone but can readily be softened with water if changes are desired.

Standing at the south edge one gets a view that would be obtained from a balloon 22 miles above Asbury Park in New Jersey.

In addition to the topographic features of mountains and rivers the model gives a complete picture of existing land uses.

Major highways and railroads are painted on the model with broken lines showing proposed additions. All this material shows the Regional Plan as of 1936.

One of the striking features shown is the obstacles which the principal waterways and mountain ranges have offered to symmetrical development. The Watchung Mountains have confined the intensive development of northern New Jersey to the sections east and south of them. The sharp valleys running north and south in Westchester and Fairfield counties, north of New York City, have made east and west communication in these districts difficult. The terminal moraine of the last glacial period can be traced along the center of Long Island and across the Narrows to Staten Island. Main waterway crossings are shown by miniature bridges. The highway pattern shows the extent to which it is proposed to bypass urban centers.

Inverse molds of each of the fifteen sections of the model from which duplicates can be cast have been prepared.

Fig. 1. Embracing an area of 6700 sq. mi., this 18 x 20 ft. model clearly shows the geographic and topographic features in the New York metropolitan region.

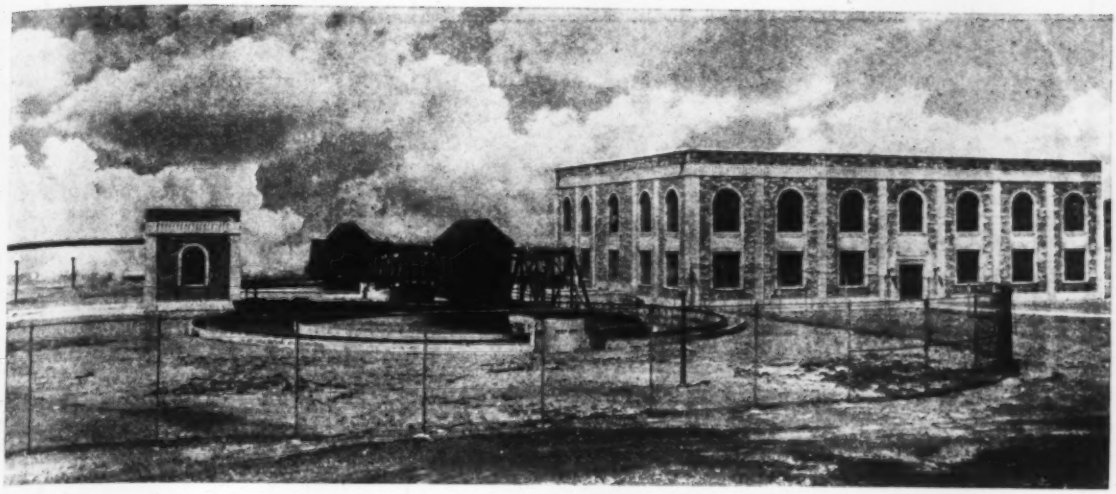

FIG. 1. PERTH AMBOY TREATS ITS SEWAGE IN THIS 10 M.G.D. PLANT

The Raritan River Cleanup

by C. J. VELZ

Acting Chief Engineer, PWA (N. J.), Newark, N. J.

Fourteen sewage disposal projects under construction or completed will put an end to pollution in New Jersey's largest intrastate waterway

FREEING of the Raritan River from serious pollution is fast becoming an accomplished fact. Aided by a $4,000,000 program which was launched with the financial assistance of the PWA, the principal communities in the valley of the largest intrastate stream in New Jersey are completing the installation of long neglected sewage disposal facilities. Fourteen projects for the reduction of pollution which include provision for treatment of about 30 m.g.d. of sewage and waste from a contributary population of more than 200,000 are expected to be in operation by 1938.

With the exception of a relatively small volume, all the sewage and industrial waste in this area have been discharged into the Raritan without treatment. With the rapid growth in population and industrial expansion in the lower valley the river was degenerating to such an alarming extent that the Port Raritan Commission in 1929 received an appropriation from the state to investigate conditions. The commission's report was followed by a sanitary survey of the state department of health and upon its findings orders were issued to all communities discharging untreated sewage into the river that this practice must be stopped. These orders were upheld in the Court of Chancery but financial paralysis created by the depression prevented action until federal loans and grants were made available.

River conditions

The Raritan River with a drainage area of 1,105 sq.mi., flows through picturesque central New Jersey. The north and south branches join about 30 miles above the mouth to form the main stem of the river, generally referred to as the lower valley. For 18 miles above Raritan Bay the waterway is tidal and navigable. Runoff of the Raritan is subject to wide variations, monthly average flow during the summer ranging from 0.17 to 2.90 sec.ft. per sq.mi., with the most probable average 0.67 sec.ft. per sq.mi.

Configuration of the stream bed is such that the passage to tidewater is relatively rapid while through the tidal region to the sea it is slow. As a result pollution is concentrated in the tidal reaches where the organic matter exerts a heavy demand on the dissolved oxygen of the water before the stream joins the ocean. The critical section of the stream which is located a short distance below the city of New Brunswick becomes practically devoid of oxygen during the summer period of low run-off. An analysis of pollution loads and natural purification capacities of the stream indicates that to insure a safe oxygen content in the river during the summer months requires treatment facilities capable of removing 65 per cent of the oxygen demand of the sewage and wastes before discharge into the stream.

Chemical treatment favored

The Raritan Valley program is not a joint undertaking but rather one in which each community, with one exception, has elected to construct an individual plant. Designs for these new plants indicate a marked revival

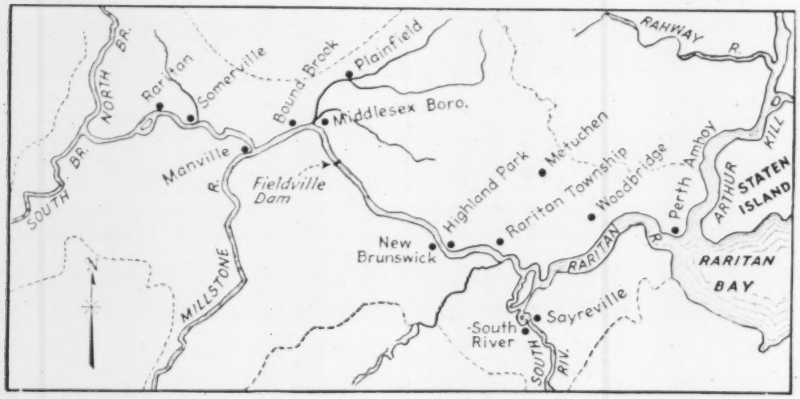

Fig. 2. Location of the sewage disposal projects in the Raritan River valley which will end pollution of New Jersey's largest intrastate waterway.

of chemical precipitation processes, the flexibility of which method lends itself to the varying conditions. Eight of the 13 plants are designed for utilization of coagulents during summer months of low runoff or for all-year-round treatment as conditions warrant.

Perth Amboy, near the mouth of the river, was the first community to take advantage of federal assistance. Construction of an extensive system of intercepting sewers and pumping stations for the collection of industrial as well as municipal waste, and a treatment works designed for a flow of 10 m.g.d. was started April, 1934 and the plant was placed in operation in June, 1935.

The treatment process employs mechanically-cleaned screens, diesel-driven pumps, flocculation by air diffusion, circular clarifiers with magnetite strainers, chlorination and vacuum filtration of undigested sludge; the latter is disposed of at the city dump. Storm-flow from combined sewers and a wide variety of industrial wastes subjects the system to extreme conditions. Ferric chloride and lime are used for coagulation during the summer period and during that season, with magnetite strainers in operation, the 5-day biochemical oxygen demand of the sewage is reduced by 70 per cent and 90 per cent removal of suspended solids is obtained. The operation of the plant has resulted in a marked improvement in Raritan Bay and the Perth Amboy shore is now extensively used for swimming.

Woodbridge Township recently received a grant allotment to make connection to the new Perth Amboy plant. Plans are underway to replace four existing inadequate settling plants with a new system of intercepting sewers, pumping station and force main to divert about 0.8 m.g.d. of sewage to Perth Amboy.

New Brunswick, the second largest city on the river, has also completed a chemical precipitation plant, capacity 9 m.g.d. This improvement project includes an extensive system of intercepting sewers and pumping stations for both industrial and municipal waste. The treatment provides chemical precipitation, separate sludge digestion, and sludge dewatering with vacuum filters. An unusually compact unit was built to fit the restricted site available.

The plant also includes mechanically-cleaned screens, mechanical flocculators, square clarifiers with rotary sludge collectors and final chlorination. The digesters are of the fixed cover type fitted with gas collection and heating coils. Dewatered sludge will be disposed of on farmland. The plant was placed in operation in March of this year as a sedimentation unit and it is proposed to employ chlorinated copperas and lime as coagulants during the summer months.

Sewage filtered by sand

Sayreville and South River, also in the tidal section of the river, have under construction treatment works utilizing chemical precipitation. These two plants of the same design, each providing for a flow of 0.75 m.g.d., include mechanical screens and grit removers, flocculation by air diffusion, circular clarifiers equipped with mechanically-cleaned sand strainers and chlorinating equipment. Raw sludge will be dewatered on vacuum filters with final disposal on abandoned land. During the summer months it is planned to employ coagulants of chlorinated copperas and lime. It is anticipated that this will provide an average removal of

TABLE I—PROJECTS FOR THE REDUCTION OF POLLUTION IN THE RARITAN VALLEY

Location	PWA Loan	Allotment Grant	Total Estimated Cost	Construction Cost Plant Only	Construction Cost Boosters-Sewers	Population Connected	Basis of Design: Flow M. G. D.	Basis of Design: Population	Type Treatment
Perth Amboy	$662,000	$259,000	$921,000	$416,021	$432,000	44,000	10.0	46,000	Chem. Precip.
Woodbridge	.....	81,000	180,000	.....	148,500*	6,000	0.8	8,000	Treated at Perth Amboy
Sayreville	.....	68,727	178,727	124,546	57,842	.....	0.75	8,000	Chem. Precip.
South River	.....	63,000	173,000	132,641	.....	11,700	0.75	12,500	" "
New Brunswick	.....	263,045	500,000	292,966	131,860	35,000	9.0	40,735	" "
Highland Park	145,000	119,045	264,045	134,591	93,810	8,691	2.0	13,000	Sedimentation
Raritan Twp.	.....	45,000	100,000	89,800*	.....	5,000	0.6	6,000	"
Metuchen	58,000	47,454	105,454	91,646	6,523	5,748	1.1	8,800	Trickling Filter
Plainfield Joint Meeting	.....	28,636	85,000	74,000	.....	58,000	.....	.....	Extensions to Trickling Filt. and Chem. Precip.
Middlesex Boro	.....	247,909	550,909	121,918	375,569	4,500	0.8	8,000	Chem. Precip.
Round Brook	.....	108,000	275,000	177,936	39,110	8,000	1.2	12,000	" "
Manville	154,000	138,150	312,000	82,541	200,997	6,000	0.8	8,000	Trickling Filter
Somerville	.....	94,909	229,909	156,254	45,163	8,900	1.9	10,000	Chem. Precip
Town of Raritan	.....	118,636	263,636	212,972	14,968	5,000	1.5	6,600	" "

*Estimated.

Fig. 3. South River is completing a chemical precipitation plant using sand strainers and sludge dewatering filters.

70 per cent of B.O.D. and 90 per cent of suspended solids. Effluents will be discharged into South River a short distance above its confluence with the Raritan River.

Highland Park which is directly opposite New Brunswick has completed a system of intercepting sewers and pumping station with primary treatment works for a flow of 2 m.g.d. The plant consists of mechanically cleaned screens with shredder, rectangular sedimentation units with sludge collectors, chlorination, separate sludge digestion and gas collection, and glass-covered sludge drying beds.

A section of Raritan Township, which adjoins Highland Park, recently received a grant allotment for the construction of a new plant, capacity 0.6 m.g.d. The design is similar to the Highland Park plant.

In the non-tidal section of the river below the potable water-shed, four plants are being installed. Under construction at Bound Brook and at Middlesex are works for flexible intermediate treatment employing chemical precipitation. The Bound Brook project, which includes interceptors and pumping stations, provides treatment facilities to handle 1.2 m.g.d. The equipment includes mechanically cleaned screens, flocculators with mechanical agitation, twin rectangular clarifiers with continuous sludge removers, chlorination, multiple-stage separate sludge digestion, and glass-covered sludge drying beds. The design, permitting flexibility in operation, is predicated on the use of plain sedimentation or coagulants with re-circulation. The Middlesex plant is similar to that at Bound Brook except that it is designed for a flow of 0.8 m.g.d., the sedimentation units are circular, and digestion is single stage. The project in Middlesex also includes the initial construction of a sanitary sewer system, trunk sewers and a booster station.

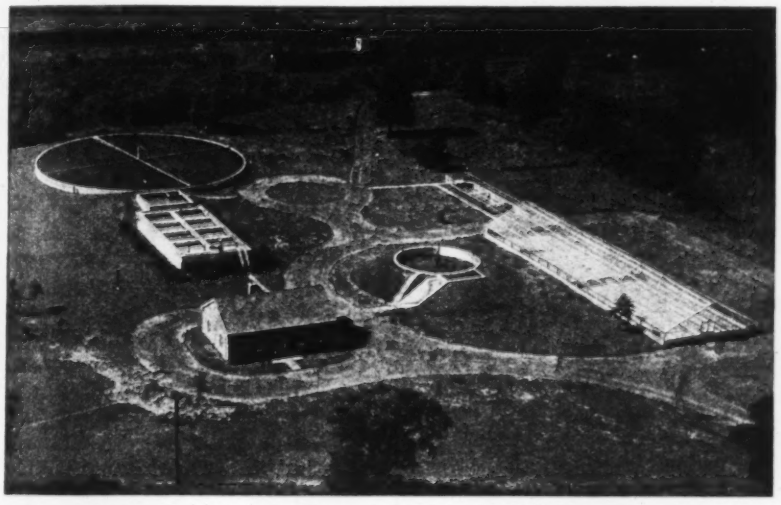

Fig. 4. Manville built a trickling filter plant to meet purification standards on a watershed furnishing a potable supply.

At the joint treatment plant of Plainfield, North Plainfield and Dunellen, which discharges into Green Brook about 2 mi. above the Raritan, additions are being made. These include sedimentation units and new digestion tanks to handle an increasing load. This plant under the supervision of John R. Downes, inventor of the floating cover for sludge digestors, is historic in the development of sewage treatment science. Improvements made in the past few years include the addition of chemical precipitation to relieve overloaded trickling filters, and a new system of spray sludge drying.

At Metuchen an old plant has been practically rebuilt to accommodate a flow of 1.1 m.g.d. Trickling filters with rotary distributor, final clarifiers and chlorination have been added. New rectangular clarifiers with continuous sludge removers replace the old circular Imhoff tank which was converted into a separate sludge digestion unit, and the old sand filter bed was converted into a sludge drying bed.

Protection to water supplies

The Raritan River to the junction of the Millstone is a source of potable water supply utilized by the towns of Somerville, Raritan, Manville and the Elizabethtown Water Co. The State Department of Health, there-

fore, established a minimum standard of effluent for sewage plants within the potable shed not to exceed 40 p.p.m. of suspended solids, 70 p.p.m. B.O.D., 50 p.p.m. oxygen consumed and *B-coli* absent in 5 c.c. samples.

To meet these requirements Manville has completed and placed in operation a trickling filter plant of 0.8 m.g.d. A sanitary sewer system and a booster pumping station were also constructed. The plant includes twin rectangular sedimentation units with continuous sludge removal, separate sludge digestion and glass-covered sludge drying beds. Clarified effluent is treated on a circular trickling filter after which it is settled in rectangular sedimentation tanks. After chlorination the final effluent is discharged below the water works intake.

Raritan and Somerville are installing plants which will utilize chemical precipitation, sand strainers and chlorination. At Raritan construction has started on a combined industrial waste and municipal sewage treatment works and garbage incinerator. The plant, designed for a flow of 1.5 m.g.d. which includes woolen mill waste, comprises mechanically-cleaned screens, flocculators with mechanical agitators, automatic chemical feeders, circular clarifiers with integral sand strainers equipped with cleaners and chlorinating equipment. Sludge from clarifiers will be chemically conditioned, dewatered to 75 per cent moisture on vacuum filters, reduced to 20 per cent moisture in a multiple hearth dryer and fed to the incinerator with garbage. The incinerator of the basket-grate type, has a capacity of 30 tons.

The Somerville plant with a design capacity of 1.9 m.g.d. is similar to the Raritan installation except that it does not include the sludge dryer or incinerator. Sludge will be dewatered by vacuum filters and will be disposed of on land. Both of these projects include the construction of pumping stations and sewers.

It is anticipated that the entire program will be completed early next year. This concerted attack upon pollution in the drainage area as a whole will go far toward reviving the beauty and utility of a great water heritage besides protecting economic interests in the rich shell-fish areas of Raritan Bay. Public response is already apparent in municipal movements to create water front parks.

Uneconomic Public Works

American Society of Civil Engineers discusses economics of large public works projects at Boston meeting

THE ECONOMIC SOUNDNESS of a number of large public works undertaken by the federal government as employment producing measures was the subject of a full day's discussion before the engineering economics and finance division of the American Society of Civil Engineers at the fall meeting of the society held in Boston, Oct. 5-8. (A report on other features of that meeting was published in last week's issue, p. 685.)

Papers prepared for presentation at the Boston meeting were planned to carry forward the division's study of public works as a factor in minimizing the effect of business depression, three being devoted to a review of the economic factors affecting such operations as the building of Fort Peck dam, the Passamaquoddy tidal power project, Grand Coulee and Bonneville power projects, the T.V.A. dams, and the Florida ship canal, and a fourth paper outlining the advantages of orderly planning of public works.

In summary, the authors of the papers found all of the major projects under discussion to be without economic justification and criticized the national administration for having withheld from the public many of the engineering reports that clearly showed that the projects could make no return commensurate with the large investment involved.

Henry E. Riggs, honorary professor of civil engineering at the University of Michigan, and official nominee for president of the society during 1938, discussed the hazards of uneconomic public construction, raising the question whether the nation is justified, in a time of great stress and of rapidly rising national debt, in engaging in business ventures which are new to government, also whether it is economically sound to spend vast sums of money in building works for the far distant future which are distinctly not needed now. The paper, Professor Riggs said, was written for the purpose of directing attention to the need for long-time planning by Congress of federal public works and of the necessity for establishing definite requirements as to accounting, publicity of statistics, and the elimination of subsidy in connection with the operation of any publicly-owned business or public service enterprise. No criticism of the design or construction methods of the projects under discussion is intended or implied, Professor Riggs added.

He said further that the fact that the construction of many of the projects now under way constitutes an entry of the government into direct competition with private enterprise in electric power or transportation industries has no bearing on any of the criticism made in his paper, that he is a thorough believer in the regulation of public service corporations and in public ownership of utilities whenever the public authorities can give better service or lower rates than private corporations can do, but he is by no means convinced that government ownership and operation of great and complex utilities is likely to be as successful or as efficient as fully regulated private ownership.

As a first example of uneconomic and unjustifiable projects, Prof. Riggs took the Passamaquoddy tidal power scheme and reviewed its history, through steadily rising estimates of cost, until the figure reached $62,000,000 for a plant with a firm power capacity of 30,000 kw., and stated, "It is obvious that either $62,000,000 or $37,000,000 to get a plant with a firm power capacity of only 30,000 kw., is many times the cost of a modern steam plant. It is equally obvious that if a steam or diesel plant is built for standby use during five hours out of every twelve, there is no reason why it should not operate all the time. If this standby

plant is built, it reduces the tidal part of the project to an absurdity."

Expenditures by the federal government to develop and maintain navigation on the Missouri River that culminated in the construction of Fort Peck Dam, were taken as a second example of how vast sums are spent without a proper effort to determine whether the objective can be obtained or is in any way justified. By the time Fort Peck Dam is completed, $267,000,000 will have been spent on the Missouri River, or more than on the whole Great Lakes navigation system. In 1935, 186,900,000 tons of freight moved in the channels of the Great Lakes, as compared with 1,841,000 tons on the Missouri; nearly all of the latter was construction material used in waterway improvement.

Grand Coulee Dam and the Columbia Basin irrigation project were reviewed in a similar manner, and it was pointed out that the Columbia Basin reclamation project, substantially as now contemplated by the Bureau of Reclamation, has been estimated by the Corps of Engineers to cost, for power, navigation and irrigation, a total of $437,000,000. Professor Riggs expressed the hope that Congress will not take hasty action on application for further appropriation for this work until it has had an exhaustive study of it made by a commission of nationally known and wholly disinterested engineers. He added that a project such as this does not fall into the class of emergency relief work and should never have been adopted without full discussion and consideration by Congress.

Rising cost estimates

Prof. Riggs called especial attention to the fact that the estimates of the cost of most of the large federal undertakings have increased from year to year. He cited Fort Peck and Bonneville dams as having been estimated to cost $117,250,000 in 1934, yet the revised estimates in 1936 put the total cost at $159,600,000. Prof. Riggs pointed out that even these estimates include no figures for transmission and distribution systems.

In conclusion, Professor Riggs said the whole discussion comes down to a question of engineering economics. "Putting to one side all argument as to whether government ownership is wise or unsound, it would appear that the general policy that ought to control the adoption of any program of public works which involves the entry of the government into any form of business or public service, whether in time of emergency or not, should be determined by the Congress only and not delegated to any bureau or commission for final decision. . . . No project should be undertaken without an exhaustive study of the construction features and market for the output by qualified engineers reporting to Congress. Every such report should be a matter of public record available to the public. There must be scores of reports, such as the PWA report on Passamaquoddy, filed in Washington, none of which has been made available to the public. . . . The writer believes that those members of the profession whose hands are not tied, who are free to tell the facts, should do so freely and should discuss the economics involved, as well as the technical features of public works."

Florida ship canal

William J. Wilgus, discussing Professor Riggs' paper, took up the Florida ship canal, and pointed out the flaws in the arguments used by those who attempted to show economic justification for the canal. Col. Wilgus laid special emphasis on the lack of enthusiasm for the canal expressed by shipping interests and pointed out that the time saving that the proponents claimed for the canal—less than one day's time—will be largely wiped out by the improvements now being made in ship design, because new ships can maintain the higher speeds in the open ocean, but will gain no benefit from the higher speeds in navigating through the canal. He also stated that the hazards in the restricted channels of the canal about equaled those involved in open sea navigation through the Florida Straits. Col. Wilgus called attention to the fact that the benefits obtained from the large expenditure would not redound to the public, but to the ship owners using the canal, a large percent of whom would be foreign ship owners.

Instead of providing work for the unemployed on useless public works, Col. Wilgus stated that the money should be used for supplying such crying needs as added public thoroughfares for our rapidly growing automobile traffic. He stated that building an international parkway along the Appalachian Uplift connecting many national and state parks and forests and other recreational areas, and reaching from the Gulf of St. Lawrence to Key West, would cost no more than the Florida ship canal and would give employment to skilled and unskilled labor in seventeen states instead of in one.

In discussion, Dugald Jackson, Cambridge, said that an effort should be made to get facts such as those presented in Prof. Riggs' paper before the public, and recommended that the division set up a small committee to undertake getting these facts and such matters as the pigeon-holing of adverse reports before the public. E. M. Hastings, chief engineer, Richmond, Fredericksburg & Potomac R.R., stated that studies for such projects as the Florida canal completely overlooked the fact that they tend to take away business from existing utilities, upon which business many people depended for employment.

The same point was made by C. Frank Allen who said that this fact should not be permitted to impede all progress, but it did call for careful consideration of any major change that would upset the stability of existing operations.

Engineers and public opinion

At the afternoon session Daniel W. Mead, speaking on the topic, "Engineering Economics and Public Opinion," stated that the engineers of this country will do less than their duty if they hesitate to discuss the federal administration's experiment in economics frankly, honestly, intelligently, and fearlessly, and bring to bear on the solution of these vital problems the best thoughts of their profession. The more these projects are discussed and their defects made plain to the public, the more likely it is that such ill-considered and extravagant projects will be prevented in the future by the development of sound public opinion. Mr. Mead then proceeded to take up several aspects of the federal administration's excursion into business, its financing of state and municipal public works as a relief measure, and in particular the operations of the Tennessee Valley Authority. In discussing the latter subject, he presented an analysis of

the probable power costs and anticipated revenues in order to point out some apparent discrepancies in statements made by executives of the TVA.

Advance planning

The economic advantages of broadly planning of public works was discussed by Frederic H. Fay, who stated that the experience of the past five years affords no adequate criteria for passing judgment on the merits and defects of the principles of planned flexibility in public works, for the reason that with certain exceptions as regard federal programs, the element of advance planning has been absent. In state, country and municipal public works, particularly, which constitute by far the greater portion of the public works field, carefully prepared plans were almost non-existant. That such sensible foresight has not been exercised to a greater degree in the past, said Mr. Fay, is due largely to lack of understanding by the public generally as to the nature and importance of planning. On the physical side, there is little comprehension by the public of the time, effort and money necessarily required for securing adequate knowledge of site conditions and for the preparation of design which shall meet those conditions in a proper and economical manner.

Basing his statement on the available records of the construction industry, Mr. Fay pointed out how far below normal construction had fallen during the depression years, and how far it still was behind normal, and how important the construction industry was to the welfare of the nation. Mr. Fay believes that a sufficient volume of genuinely needed public works can be found in depression periods to give substantial employment, but that it must not be expected that such a program will do more than provide direct employment for the idle workers within the construction industry itself. The program should not attempt to provide work for people outside the construction industry, except as the program has an indirect effect on other operations.

Important elements of the advance planning are making arrangements for financing the work and for timing it. Such planning can best be secured through some form of non-political planning agency acting independently of other governmental departments and free from all administrative responsibility for carrying out the projects.

Prof. James K. Finch, in discussing the papers by Prof. Riggs and Col. Wilgus, stated that the evidence shows that the federal government had plenty of engineering opinion on its large projects, but that it did not welcome opinions that were unfavorable, and so kept them from the public view. He said that politicians do not seek the advice of agencies set up by the engineering profession, such as American Engineering Council, and that if the profession is to be more effective it must pocket its modesty in the interest of public service and make an aggressive attitude in bringing its views to the attention of the public. He cited what the Bar Association has done.

Viewing present trends, Prof. Finch said that engineers need to plan a system in which the development of national resources is no longer left in private hands, a system in which there will be the maximum amount of cooperation between existing private development and future developments by government agencies.

C. A. Bingham, Boston, taking exception to Prof. Rigg's statement that advance planning had been lacking, expressed the opinion that all cities had not been negligent in advance planning, and pointed out what some cities had been able to do under the C.W.A. when they had plans ready for work that could be done by that agency. Mr. Bingham urged engineers to get out and take an interest in their own communities. The same view was endorsed by Prof. Riggs.

Summing up the discussion, Frederick H. McDonald, stated he felt that the matters brought out at the meeting served not so much as an indictment of the government for starting large projects that lacked economic justification as it was an indictment of those who had suppressed the adverse reports concerning these projects, thus keeping the public in the dark concerning them. He expressed the view that caution should be exercised in condemning projects that appeared visionary at the moment, pointing out that many projects undertaken in the past, at a time when conservatives looked upon them as visionary, had turned out to be of national importance.

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Many Cities Planning Housing Projects

WITH THE ENACTMENT of the Wagner low-rent-housing bill, now designated the United States housing law of 1937, many cities are authorizing Housing Authorities or are fostering plans to do so.

Within the past few weeks Authorities have been organized in Pittsburgh, Scranton, Allentown, Chester and Philadelphia. In York, Pa., the mayor and the council are preparing to establish an Authority and the city engineer is studying the problem areas of the city. Considerable preliminary work has been done and York should be among the first cities to present an application. In Baltimore, a Mayor's Housing Committee has been formed while a civic committee has also organized to place the power of public sentiment behind the city administration.

Florida cities are also active. Jacksonville contemplates clearing slum areas and erecting extreme low-rent housing, while Tampa and St. Petersburg are both making studies of their slum areas and housing needs.

Among the trends noticeable in the housing studies being made by cities is the marked preference shown for the individual-detached-housing-unit. The elaborate and costly apartment-type of housing erected by the Housing Division is being discarded by the smaller cities.

In New York State, Albany and Rochester are planning to create Authorities while New York City, Yonkers, Syracuse and Schenectady now have projects ready for presentation. In Massachusetts, Fall River, New Bedford and Lowell, and in Connecticut, Bridgeport, New Britain and Hartford represent New England's recent interest in the program. Detroit is the only Michigan city that can participate at present, but Pontiac and Grand Rapids are busy with plans and it is expected that Governor Murphy will call a special session of the Michigan legislature so that all Michigan cities may qualify.

BOOK NOTES AND REVIEWS

The month's additions to the engineer's reading and reference list

Modern Reinforced Concrete

REINFORCED CONCRETE CONSTRUCTION — VOL. I — FUNDAMENTAL PRINCIPLES—Fourth Edition—By George A. Hool, revised by Harry E. Pulver. 441 pp. Published by McGraw-Hill Book Company, New York and London. Price $4.00.

The term "modern" is subject to much abuse, but in the field of reinforced concrete design, it means 1936, because the new regulations of the American Concrete Institute which came out in that year are in many respects quite different from the ones that they replaced. As a consequence, revised texts such as this one are actually new books. For example shrinkage and plastic flow are given major consideration. Higher stresses are used in the design tables and diagrams. Slabs supported on four sides are given extended treatment. In addition to including such new elements as these, Prof. Pulver has rewritten the entire text matter to make it conform to modern practice.

Housing

HOUSING OFFICIALS YEAR BOOK, 1937—By Coleman Woodbury, director, National Association of Housing Officials. 213 pp. Published by the association, Chicago.

Summarization of activities in the broad yet specialized field of housing is contained in this housing annual. Generalizing, the editor, Coleman Woodbury, states that 1936 was an uneven year but that most housing organizations and agencies can report substantial physical achievements, matured ideas and plans along with greater tolerance of other agencies, their needs and methods. Discussions have been more concrete dealing with desirable physical standards, tenant selection, sources of mortgage and subsidy funds, and the relation of different types of housing enterprises to one another. Justification of the book, Mr. Woodbury states, lies in its use as a source of facts for students and newcomers in the field and as a help to level up the general practice of housing agencies.

The volume contains summaries by federal agencies, activities of state and local bodies, eleven papers on problems and practices of current interest by authorities in the field, summaries of housing, a directory of agencies and a bibliography.

Home Builders Service

FEDERAL HOME BUILDING SERVICE PLAN—Prepared by the Federal Home Loan Bank Board. 67 pp. Published by the Federal Home Loan Bank Board, Washington, D. C.

The plan outlined in *Engineering News-Record* of Mar. 19, 1936, p. 412 by which the Home Loan Bank Board seeks to assure the home owner of better and cheaper building, is presented in a flashy, catalog-type book recently issued by the board. Presumably copies may be obtained by anyone on application to the board at Washington.

Inventions and Progress

TECHNOLOGICAL TRENDS AND NATIONAL POLICY—Including the Social Implications of the New Inventions—June, 1937. 388 pp. Report of the Subcommittee on Technology to the National Resources Committee. For sale by the Superintendent of Documents, Washington, D. C. Price $1.00.

For those who must have reading matter to fill a large block of vacant time the National Resources Committee has just produced a ponderous volume, "Technological Trends and National Policy—Including the Social Implications of New Inventions." The volume does not seem to throw much light on the employment problem, but it does confirm the well-known fact that "inventions create jobs as well as take them away."

The science committee found that "in all the fields of technology and applied science that were investigated there were many new inventions that will have important influence upon society, and hence upon all planning problems." It proposes the formation of a permanent, over-all planning board to "take its place in the governmental pattern as coordinator for the many planning boards." It also suggests that a governmental joint committee be formed to keep abreast of technological developments and what are likely to be imminent technological changes bearing on unemployment.

Construction is represented by a chapter containing monographs by L. J. Chawner, Carlton S. Proctor (foundations), O. H. Ammann and E. W. Bowden (bridges), H. W. Richardson and R. F. Schaefer (tunnels and subways), John C. Page (dams), Malcolm Pirnie (water supply and sewage disposal), and J. L. Harrison (highways).

Soil Mechanics

ENGINEERING PROPERTIES OF SOIL—by C. A. Hogentogler and C. A. Hogentogler, Jr., 434 pp. Published by McGraw-Hill Book Co., New York and London. Price $5.

The author and his associates have made a valuable contribution in bringing together their experiences with soils in highway construction. From their association with the Bureau of Public Roads all of the collaborators and particularly Mr. Hogentogler have been on the firing line in soil research for a number of years and are eminently qualified to present the subject to the engineering profession. It is presented largely from the viewpoint of highway construction although the title must lead one to look for a wider scope. Soil mechanics is certainly important enough in the field of highways to justify treatment from that viewpoint alone and in directing attention to this limitation in scope the intent is not to criticize unfavorably. Much of the material is, of course, applicable to other fields in which such knowledge is needed.

In the present stage of development in soil mechanics there are a number of problems not yet solved to the satisfaction of many investigators and they must be presented as the best available information. In the discussion of capillarity and development of the formulae for capillary rise the authors continue a current misconception that so-called surface tension is due to a surface skin with definite tensile strength.

Authorities on physical chemistry seem to be in complete agreement that there is no "contractile skin" at the liquid surface but a free energy which exerts an inward force nor-

mal to the surface caused by an unbalanced molecular attraction exerted on surface molecules by molecules in the interior of the liquid. Surface tension is an analogy which simplifies the mathematics of dealing with free surface energy and it appears that mistaking it for a reality is confusing the mechanics of soil moisture and leading to some serious misconceptions. The writer questions the wisdom of presenting such an analogy without rather emphatically calling attention to its limitations.

The movement of soil moisture other than capillary water is concisely treated giving a clear conception of essential relations necessary for the solution of practical problems. The treatment of frost phenomena is also well done. One omission is to be noted in that the theory of frost heaving attributed to fluctuations in the depth of frost penetration was first presented by Bankelman and Olmstead. The experiments demonstrating this theory, which is an explanation of heaving in soils of coarse texture, were conducted by the Michigan State Highway Department in the laboratory at the University of Michigan by F. R. Olmstead, the originator of the theory.

The theory of consolidation is presented in the most satisfactory manner that the writer has encountered, but other theories of soil resistance are rather incomplete.

Several inconsistencies may be noted. In discussion of the pressure bulb it is stated that footing design depends on a limiting settlement without reference to a safe bearing value depending on the shear resistance of the soil. With this the writer cannot agree. However, in the section on shearing strength the importance of the safe bearing value as controlled by resistance to lateral displacement is recognized. Formula 64 on page 212 is the ratio of principal pressures given in Coulomb's original theory of earth pressure but is presented by the authors as Terzaghi's formula.

The assumption that in strictly granular soils the angle of repose and the angle of internal friction may be assumed as equal appears dangerous and to be in opposition to the view held by most investigators who have reviewed available experimental evidence. The presentation of internal stability of earth masses follows the conventional internal friction theories and conforms to the widely accepted views.

The last section of the book on practice in design and construction is the most comprehensive section of all, the subject of soil stabilization being particularly good.

The chapter on soft foundation soils is devoted largely to fill construction. The treatment of piles is not nearly complete enough from the standpoint of foundations for bridges and buildings.

In conclusion the writer would summarize his review with the statement that the book is a valuable reference book for highway engineers, entirely suitable as a text for a course in soils for highway construction, but of limited value for a general course in soil mechanics.—*Reviewed by* W. S. Housel, *Associate Professor of Civil Engineering, University of Michigan, Ann Arbor.*

MISCELLANEOUS NOTES ON BOOKLETS AND REPRINTS

The Strength of Thin Cylindrical Shells in Columns: A report of an investigation made jointly by the Engineering Experiment Station, University of Illinois, and the Chicago Bridge & Iron Works. Bulletin 255, Engineering Experiment Station, Urbana, Ill. Price, 50c.

Progress Reports No. 3, 4 and 5 on stress distribution in steel rigid frames, three progress reports from the National Bureau of Standards, have been published in pamphlet form by the American Institute of Steel Construction, 200 Madison Ave., New York.

A Standard Filing System and alphabetical index of the American Institute of Architects for use in filing information on building materials and appliances has been re-issued in a 1937 edition as A.I.A. Document No. 172. Price $1. from the Institute, 1741 New York Ave., Washington, D. C.

Soil Mechanics is the subject of five bulletins put out as the first publications of Centre d'Etudes et de Recherches Geotechniques, Paris, under the following titles: Definitions et Essais, Elements du Calcul des Affaissements, Les Affaissements de la Gare Translanteque du Havre, Fondations de Fours a Gaz Nice, Erosion Interne. Copies may be obtained from Louis Reynaud, 52, Rue d'Assas, Paris, France.

A Manual of Concrete Curing has been published by the Columbia Alkali Corp., Barberton, Ohio, giving some considerable material on the use of calcium chloride and curing of concrete. The present revision takes into consideration the new A.S.T.M. specifications for the use of calcium chloride.

NEW PUBLICATIONS

SEWERS—THEORY, DESIGN, SPECIFICATION AND CONSTRUCTION—By E. V. Bevan and B. T. Rees. 334 pp. Published by Chapman & Hall, Covent Garden, London, Price 25 s. net.

AMERICAN PLANNING AND CIVIC ANNUAL—Edited by Harlean James. 404 pp. Published by the American Planning and Civic Association, Union Trust Bldg., Washington. Price $3; $2 to members of the association.

PARKWAYS AND LAND VALUES—By John Nolen and Henry V. Hubbard. 135 pp. Published as part of the Harvard City Planning Studies (XI) by the Harvard University Press, Cambridge, Mass. Price $1.50.

THE STORY OF TUNNELS—By Archibald Black. 245 pp. Published by McGraw-Hill Book Co., New York and London. Price $2.75.

THREE MILLION HOUSES—By Sir Charles Morgan-Webb. 197 pp. Published by the Committee for the Nation, 205 East 42nd St., New York. Price $1.50 ($1.00 paper-bound).

SOUTHERN PINE MANUAL OF WOOD CONSTRUCTION—13th Edition. 200 pp. Prepared and published by the Southern Pine Association, New Orleans, La. Price $1.

THE PORT OF PORTLAND MAINE—Port Series No. 1—Prepared by the Board of Engineers for Rivers and Harbors, War Department, 125 pp. Price $.25 from Supt. of Documents, Washington, D. C.

1937 SUPPLEMENT TO BOOK OF A.S.T.M. STANDARDS—272 pp. Prepared and published by the American Society for Testing Materials, Philadelphia, Pa.

THEORY OF STATICALLY INDETERMINATE STRUCTURES — By Walter M. Fife and John B. Wilbur. First Edition. 248 pp. Published by McGraw-Hill Book Co., New York and London. Price $3.50.

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

Pond Bottoms Sealed By Bentonite

by C. C. DAVIS

Forestry Division, TVA, Knoxville, Tenn.

Ponds at the Norris fish hatchery which were losing water by bottom seepage have been made tight by the following procedure. Three ponds roughly square in shape and covering about 2.1 acres each were treated. The material used was grade number 80 KWK Volclay, which is mined and processed at Belle Fourche, S. D.

The ponds were drained and allowed to dry sufficiently to be plowable, and were then plowed to a depth of 8 in. by an ordinary farm plow. After plowing, the bottoms were rolled with a sheep's-foot roller in 18-in. laps so that each square foot received about three rollings. The rolling was followed by a drag to take out surface irregularities. Pond No. 1 was then staked in 20-ft. squares and one bag (100 lb.) of the binder to a square (400 sq. ft.) was applied; ponds 2 and 3 were staked 20x25 ft. making one bag cover 500 sq. ft.

The spreading of material was done by hand, and this was followed immediately by raking the material into the top 1½ in. of soil. The bottom was again rolled with a sheep's-foot roller, until the feet no longer sank into the dirt. It was then dragged once more to smooth out the surface and was then flooded. The results were:

Pond	Loss before, g.p.m.	Loss after, g.p.m.
1	350	56
2	270	32
3	167	17

These losses are computed without taking into consideration the factor of evaporation which is a much higher per cent of the total loss after treatment than before.

Spreading bentonite to seal pond bottom.

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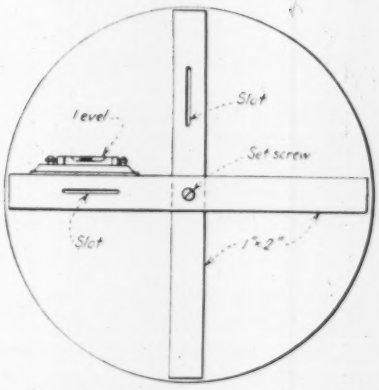
Sighting Square Lines Up Jacked Pipe

by JOHN SCOTZIN

State Department of Highways, Harrisburg, Pa.

In jacking a 3-ft. pipe culvert more than 200 ft. long through a 66-ft. fill, line and grade were kept accurate by the simple sighting square shown by the accompanying sketch. Two boards, ½x3x36 in. are bolted together in the center so that they can be folded up or opened to right angles at the digger's convenience. Each board has a slit in it about ⅛ in. wide and 6 in. long and a small carpenter's level is attached to the arm which will be in the horizontal position when the square is set up in the pipe. The digger places the square in position in the pipe and by holding his light back of each



Sighting square keeps jacked pipe in line

slit a man on the outside by looking across two nails checks the pipe as to line or grade at the front end; the back end is held to line and grade by guide timbers. The best method of guiding the pipe is to dig slightly more on the side toward which it is wished to throw the pipe, and then with a bar pull the front end over at each jacking operation. Very little effect can be obtained by tightening up on one jack more than on the other.

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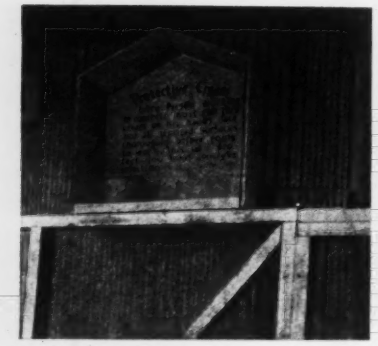
Brooms on Motor Patrols Spread Stone Chips

by WALLACE B. KANE

Springfield, Mo.

Two Missouri contractors have used motor patrols economically to spread stone chips as cover material in sealing bituminous mat. In October, 1936, The Garrett Construction Co. sealed 12 miles of mat in about three days working time; the haul did not exceed 3 mi. from the chip stock-piles and conditions were very favorable. In August, 1937, the Granite Bituminous Paving Co. sealed 7 mi. of bituminous mat in less than three days with a maximum haul of 9 mi. from the stockpile.

Two rows of hand brooms were bolted to a 2x8-in. x 12-ft. oak plank. The hand brooms were 4½ in. wide and 14 in. long and were four rows of bristles in width and 24 rows of bristles in length; the bristles were composed of twelve wires, 5 in. long. Eleven brooms were placed end to end and a second row placed tight against the first. Two planks with brooms mounted in this manner were required.



CAMERA MEMORANDA OF CONSTRUCTION AIDS

1. Workers in concrete at Grand Coulee Dam are helped to avoid skin irritation and infection and sunburn by cold cream supplied in gallon jars by the contractors.

2. And when men have proved that they are careless and unsafe to work with and must be discharged the same contractors post their names. The words in the bottom line are: "Try and keep your name off this list."

3. At one of the camp buildings an ingenious use of old precast concrete pipes produced a stairway.

Motor patrol with brooms on the mould board spreads stone chips.

The bit was then removed from the mould board of the motor patrol and one plank with the mounted brooms was placed on the front and one on the back side of the mould board, and braced rigidly in this position. This mounting must be as rigid as possible and the ends of the planks bolted together where they extend past the ends of the mould board. The ends of the bristles should extend about 2 in. below the mould board, and the front brooms should be about ½ in. higher than the brooms back of the mould board in the assembly.

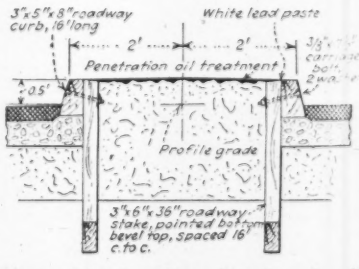
The arrangement described gives four rows of brooms parallel to the mould board, with an opening about 4 in. wide under the mould board. This opening is necessary for proper operation, for after the front brooms have drifted up any excess of chips, those that pass under are rolled ahead and leveled off by the second row of brooms in this 4 in. space, securing a uniform covering of the road surface.

An operator will, with very little experience, drift chips to the edge of the surface with a minimum waste beyond the edge. Any lack of cover may be increased or excess covering reduced since the mould board may be revolved to drift chips in any direction, or the patrol can be operated in reverse if necessary, none of which operations is possible with a drag broom. Should the bristles become coated with asphalt, brooming clean gravel will remove all such coating from them.

Redwood Center Curbs

Center islands separating opposing traffic lanes on a number of recent California roads are being constructed with redwood curbs. The design varies somewhat but that shown by the accompanying drawing is a good example. Under state highway department specifications it costs about $2,000 a mile for two rows of this curbing.

The initial installation of redwood curbing was on the east bayshore approach to the San Francisco-Oakland Bay Bridge. A similar curbing has been specified for the dividing strip on the new Cuesta Grade construction between Santa Margarita and San Luis Obispo; about 30,000 ft. of roadway will be so protected. Between Greenville and Mountain House on U. S. Route 50 in Alameda County, 73,000 lin. ft. of curb is designed with a batter face to the roadway. This batter (1:4) makes it possible to cut two sections of curb from an 8 x 8-in. timber.



Center island, with redwood curbs, for a California highway.

THE WEEK'S EVENTS

Continued from page 699

Montreal Builders Protest Bidding Procedure

A strongly worded protest against the present secrecy which surrounds contract awards made for public works by the provincial government of Quebec has been addressed to Premier Duplessis, head of the government, by the Montreal Builders Exchange Inc., representative body of the construction industry in the Montreal district. Copies of the letter were sent to all members of the provincial legislature, and to representative public bodies.

The Exchange urges upon the government the adoption of the practice, used by the dominion government for all public works, of publicly calling bids on work costing more than $5,000. It is urged that legislation be passed making such a practice obligatory for all provincial public works.

Recent contract awards, notably those for the bridge across the Back River, at Montreal, called the Pius IX Bridge, have given rise to this protest, together with the rumor that the contracts for the reconstruction of the highway bridge at the east end of the island of Montreal are to be awarded in the same way.

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Penn Electrification Ahead of Schedule

The Pennsylvania Railroad announced Oct. 11 that work on its eastern electrification program is several months ahead of schedule. When the program was announced last January it was expected that the work would take 18 months, or until midsummer of 1938. It is now announced that this schedule will be bettered by several months, though an exact date cannot as yet be set.

At present attention is being centered upon finishing the electrification of the main line from Paoli, Pa., present terminus of the electrified area, to Harrisburg. Preliminary test runs will be made into this territory very soon, after which regular passenger service will be placed under electric power and the freight service shortly thereafter. The entire present electrification project including several freight routes off the main line, is 65 per cent complete. Electrification of the passenger trackage on the Paoli-Harrisburg line is now about 75 per cent complete.

The program now under way supplements and extends into new territory the electrification completed in 1935 between New York, Philadelphia, Baltimore and Washington. When it is completed, the program will permit electrical operation of all principal eastern seaboard lines of the Pennsylvania.

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Directing Board Is Named For Cleveland Utilities

In order adequately to handle the largest construction program which the utilities department of the city of Cleveland has had under way in many years, the department has been placed under a "non-political board of control." In addition to department director, Frank O. Wallene, and his secretary, the board will consist of Joseph W. Ellms, city sanitary engineer, who will be commissioner of a new division of sewage treatment and disposal; George C. Oxer, as commissioner of light and power; and L. A. Quayle, chief engineer of the utilities department, who remains as acting commissioner of water as well as chief engineer.

The department will have under way in the next year a development program costing from $7,000,000 to $10,000,000. It will include completion of the $25,000,000 sewage disposal system, under construction since 1922, and the beginning of its operation in the spring. Expansion of the municipal light plant and improvements to the distribution lines and the street lighting system will be financed by a $3,000,000 bond issue in addition to a $500,000 program already under way out of profits. A $1,500,000 WPA project for development of the water system by a new intake canal and pumping station is under way as well as a $500,000 reservoir and other projects amounting to several hundred thousands. Mr. Ellms has been connected with the city since 1916. A graduate of Massachusetts Institute of Technology in 1893 and the Boston laboratories of the Massachusetts Board of Health in 1895, he is the author of "Water Purification" and of numerous technical papers. From 1896 to 1916 he served in Ohio river purification work for the cities of Louisville and Cincinnati and also with the Brooklyn board of health.

Missouri Epidemic Damage Award Appealed

The Springfield City Water Co., Springfield, Mo., has appealed to the Springfield court of appeals a judgment rendered late last month by the circuit court at Ozark, Mo., in which Jesse Martin was awarded $2,999 on his claim that he contracted typhoid in the summer of 1936 from drinking water supplied the city of Springfield by the water company.

The case is the first to be tried of 77 suits pending against the company which arose out of a dysentery and typhoid epidemic during the month of July 1936. A dysentery epidemic started early in July, 1936 and ended about the first of August; during the month an estimated 25,000 cases of dysentery developed in the city. An analysis of the city water made by Ralph Brooks, city bacteriologist, showed the presence of gas formers on July 15, but the analysis was not carried out to determine whether these were on a harmfull type. B-Coli was found in the water on July 18, 19 and 20.

On July 23, Dr. Newell Zeigler of the University of Missouri began an analysis of the water, and during the next three or four days he found paratyphoid-like organisms. About 10 to 14 days later typhoid began to develop in the city, rising to about 240 cases.

Jesse Martin claimed that he contracted typhoid July 23. The company claimed that he had had typhoid all through the month of July, but the jury accepted Dr. Zeigler's opinion that his typhoid was caused by the water.

The 77 cases still pending against the water company involve about $400,000 damages.

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Buenos Aires Loses Water In Offshore Wind

A high offshore wind on Oct. 9, blowing the waters of the River Plate so far toward the Uruguayan shore, 35 miles away, that the city's water supply intakes were left high and dry, gave the city of Buenos Aires a day without water. In the ship channel, where there is ordinarily 21 ft. of water, the depth was reduced by the wind to 6 ft.

Announcement was made in the morning by the city that there would be a water shortage, and citizens immediately gathered up and stored all available supplies of water. City sprinkling carts brought water from the lakes in the city parks.

The wind dropped in the evening, and on Oct. 10 the water supply was again normal.

PERSONAL

R. S. EADIE has been appointed assistant chief engineer of the Dominion Bridge Co., succeeding Fred Newell.

D. B. ARMSTRONG has been appointed designing engineer of Dominion Bridge Co. Ltd.

FRED E. GARTZKE has been appointed city engineer of Iowa City, Iowa.

W. A. SPELLMAN, consulting engineer of Kitchener, Ont., has been made engineer of Teck Township with offices at Kirkland Lake, Ont.

PAUL H. UNDERWOOD has become director of the Cornell school of civil engineering, succeeding S. C. Hollister.

EDWARD L. MOULTON has retired after 50 years service from his position as senior engineer in the Boston street department.

FREDERICK A. LOVEJOY, engineer of design in the Boston sewer division, has retired after 50 years with the city.

JAMES H. MANNING has resigned his position as president and chairman of the board of Stone & Webster Engineering Corp. in order to devote more time to personal affairs.

ROSS A. GRIDLEY, state engineer inspector for PWA in Alaska, has been transferred to Portland, Ore. as PWA regional engineer for Washington, Oregon and Idaho.

E. B. DONOHUE has been appointed chief engineer of the Montana State Water Conservation Board. He succeeds J. F. James, state engineer, who will continue as a board member.

FRANK M. STOCKING has been named chief engineer of the Washington State Land Office. Mr. Stocking has served the state in various engineering capacities since 1913.

S. C. HOLLISTER is relinquishing his duties as director of the school of civil engineering of Cornell University to head the administrative staff of the college of engineering.

JOHN LATENSER, JR., state PWA director in Nebraska since 1933, has resigned that position to practice privately as an architect and construction engineer.

WILLIAM RAISCH has opened an office in New York City for the practice of consulting sanitary engineering. He has recently been connected with the Municipal Sanitary Service Corp. of New York City.

F. P. SHEARWOOD, chief engineer of the Dominion Bridge Co., Ltd., of Canada, has resigned that position and is appointed consulting engineer for the company. He has served with Dominion Bridge for 50 years.

O. R. TOMAN, secretary-treasurer of the Midwestern Engineering Corp., Hastings, Neb., has disposed of his interest in that corporation and resumed private practice in Lincoln, Neb.

T. A. STOUT, for 4½ years manager of the Catlettsburg, Kenova & Cerevo Water Co. of Catlettsburg, Ky., has been made assistant to the chief engineer of the Northeast Water & Electric Service Corp. at Latrobe, Pa.

JOHN R. LOTZ has been elected president of Stone & Webster Engineering Corp. Mr. Lotz has been associated with Stone & Webster for 30 years; for the past seven years he has been executive vice-president and before that was construction manager.

LIEUT. COL. LINCOLN B. CHAMBERS, district engineer for the U. S. Engineer Department at Sacramento, has been promoted to the rank of colonel. Colonel Chambers has been in the service for 29 years. He was appointed a lieutenant colonel in 1933.

A. P. JONES, formerly engineer on the All-American Canal project for the Bureau of Reclamation, has been made resident engineer for the bureau in charge of construction on the Fallon-Glendive unit of the Buffalo Rapids irrigation project in Montana.

FRED NEWELL, assistant chief engineer of the Dominion Bridge Co., has been appointed chief engineer succeeding F. P. Shearwood. He joined the company in 1908 in the mechanical department, advancing to the position of chief mechanical engineer and then to assistant chief engineer.

DAVID R. SMITH, for the past two years inspecting engineer on paving contracts for the New Brunswick department of public works, has been appointed director of the newly created department of public works of St. John, N. B. The new department is an amalgamation of the former departments of streets, water and sewerage, and public lands and buildings.

SVEND A. CANARIIS has been appointed waterworks electrification engineer in the industrial department of the Westinghouse Electric & Mfg. Co. Before taking his new position, Mr. Canariis was for seven years electrical engineer in the water bureau of the Pittsburgh department of public works. He received his technical education at the University of Copenhagen and since coming to this country in 1922 he has been connected with a number of large utility and government projects. He was electrical designer for H. L. Cooper on the Wilson dam and has been connected with the Alabama Power Co. and the Duquesne Light Co.

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New Jersey Water Plant Opposed at Meeting

The plan for reorganization of New Jersey's complex water supply organization, which was introduced into the 1937 session of the legislature but not acted upon (*ENR*, March 11, 1937, p. 388) was strongly opposed in resolutions passed at the Atlantic City meeting of the New Jersey section of the American Water Works Association Oct. 15-16. Reiterating the seriousness of the Jersey water supply situation and the threat of a water shortage arising from the lack of action which has been caused by the conflict of authority between the North Jersey District Water Supply Commission and the State Water Policy commission, the waterworks men asserted the need for a single commission with power to finance, construct and operate water supply structures in the state.

Pending legislation condemned by the meeting would place the determination of policies and the financing of projects in the hands of the State Water Policy Commission, and the North Jersey District Commission would be given jurisdiction over construction and operation of projects. This plan was held to be inadequate.

A further resolution directed the New Jersey Section's committee on additional water supply and the board of trustees of the section to prepare more suitable legislation and take steps to have it introduced.

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Hardy Cross Given Degree By Lehigh University

Hardy Cross, new head of the Department of Civil Engineering at Yale University, was granted the honorary degree of doctor of engineering by Lehigh University, Bethlehem, Pa., at its 59th founders' day exercises Oct. 6.

Another doctorate of engineering was extended to Ervin G. Bailey of the Babcock & Wilcox Co., New York.

OBITUARY

GEORGE P. LETT, 69, an engineer and inspector for the city of St. Louis, Mo., died there Oct. 12.

LANGFORD C. WHITFORD, western New York building contractor, died in Wellsville, N. Y., Oct. 13 at the age of 49. His firm built many school buildings in Alleghany county as well as most of the present buildings at Alfred University.

HERBERT B. LEWIS, 77, for the past nineteen years a draftsman for the Imperial Irrigation District at El Centro, Calif., died Oct. 12. Before taking the position at El Centro, Mr. Lewis had been employed for thirteen years in the city engineer's office at Los Angeles, Calif.

SIR JOHN DEWRANCE, head of the British firm of Dewrance & Co., engineers, and recently retired chairman of Babcock & Wilcox, died in Thetford, England, recently at the age of 79. He was a past president of the Institution of Mechanical Engineers and an associate member of the Royal Engineers Board, and held the Watt Gold Medal and a Telford premium of the Institution of Civil Engineers.

AUGUST G. NOLTE, water analyst for the Missouri State Board of Health, and who had been a chemical engineer for the St. Louis water department for 17 years before holding that position, died Oct. 14 in St. Louis at the age of 51. A graduate of Washington University, Mr. Nolte began work for the St. Louis water department about 23 years ago. He was later employed for six years by the federal government as a sanitary engineer in the Canal Zone. He had been with the State Department for about 3 years.

WILLIAM H. CUSHMAN, civil and hydraulic engineer and assistant field engineer for the WPA at Watertown, N. Y., was killed in an automobile accident on Oct. 11 at the age of 68. Mr. Cushman was a graduate of the Massachusetts Institute of Technology, and after several years on various sanitary and water projects, he became engineer in charge of the Massena power project of the Aluminum Co. of America, holding that position from 1897 to 1902. He built power plants at Huntington, Pa. and Hales Bar, Tenn., Espacada, Ore., and in Costa Rica and was for a time engaged on the New York State barge canal. From 1917 to 1925 Mr. Cushman was connected with the water power appraisal firm of Jones & Hazel at Watertown and also practiced as a consultant on a number of power projects. After he left the Jones & Hazel firm, Mr. Cushman practiced in Watertown in association with Jay Phillips until 1930. Since 1934 he has held engineering posts with the CWA, the TERA and the WPA.

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Richilieu Dam Bids Asked

Bids are being asked by the Canadian department of public works for construction of a concrete control dam with steel regulating gates at Fryer's Island on the Richilieu River in Quebec. The bids will be opened Nov. 5.

This is the regulating dam, plans for which were approved by the International Joint Commission of Boundary Waters last June (*ENR*, June 17, 1937, p. 894). The cost of the dam is estimated at about $500,000.

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Strict Diversion Control Asked by Road Builders

The National Highway Advisory Council of the American Road Builders Association, at a recent meeting in Washington, passed resolutions asking that the section of the Hayden-Cartwright road act of 1934 which provides for reduction in the federal-aid allotments of those states which divert highway funds to other purposes be strengthened to provide that federal funds for which a state cannot qualify within a set period be returned to a special fund for reapportionment to those states in which no diversion of motor vehicle revenues has been made.

Other resolutions endorse the contract system on highway work; call for an appropriation for the study of super-highways with limited freeways; ask an increase of federal appropriations for secondary roads; urge a more forceful fight against motor vehicle tax diversion and the setting up of a uniform accounting system in the states under the supervision of the Bureau of Public Roads and ask for an increase in federal-aid appropriation.

Among those present at the meeting were Murray D. Van Wagoner, state highway commissioner, Michigan; Charles D. Vail, state highway engineer, Colorado; A. E. O'Brien, secretary, Associated Pennsylvania Constructors, and J. B. Kenny, secretary, Colorado Association of Highway Contractors.

The next meeting of the Advisory Council will be held at the annual road show and convention of the American Road Builders Association in Cleveland Jan. 17-21.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, annual convention, White Sulphur Springs, W. Va., Oct. 27-29.

HIGHWAY RESEARCH BOARD, annual meeting, Washington, D. C., Dec. 1-3.

THE ASPHALT INSTITUTE, national asphalt conference, Memphis, Dec. 6-13.

ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS, annual meeting, Memphis, Dec. 6-11.

UNIVERSITY OF KENTUCKY, road and street school, Lexington, Ky., Dec. 6-9.

REGIONAL AND LOCAL

SECTION MEETINGS, AMERICAN WATER WORKS ASSOCIATION:
Virginia, Richmond, Nov. 4-6.
Missouri Valley, Omaha, Neb., Nov. 4-6
Wisconsin, Green Bay, Nov. 8-10.

AMERICAN ASSOCIATION OF ENGINEERS, annual meeting of the Illinois Conference of Professional Engineers, Hotel Jefferson, Peoria, Oct. 22-23.

TEXAS PUBLIC HEALTH ASSOCIATION, annual meeting, Dallas, Nov. 1-3.

AMERICAN SOCIETY OF CIVIL ENGINEERS, IOWA SECTION, AND IOWA ENGINEERING SOCIETY, joint annual meeting, Ames, Iowa, Nov. 18.

NEW JERSEY ASSOCIATION OF PROFESSIONAL ENGINEERS AND LAND SURVEYORS, Elks Club, Jersey City, N. J., Jan. 14-15.

ELECTIONS AND ACTIVITIES

R. T. CHALLENDER has been elected president of the Montana Society of Engineers. Other officers are G. G. Griswold, Jr., first vice-president; F. A. Linforth, second vice-president; G. L. Shue, secretary-treasurer, and W. M. Cobleigh and F. E. Buck, trustees.

NEW OFFICERS elected at a recent annual meeting of the directors of the National Slag Association in Pittsburgh are: president, George A. Mattison, Jr.; vice-president, L. E. McDermut; and secretary-treasurer, H. J. Love.

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License Examinations

NEW YORK: Examinations for professional engineering Jan. 24-26, and for land surveying Jan. 27, at Albany, Buffalo, New York and Syracuse. Applications must be filed Nov. 1.

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

CANAL EARTH LINING, CALIF.

OWNER: U. S. Bureau Reclamation, L. J. Foster, const. engr.

PROJECT: Earth lining for All-American Canal, California, near intake end. Lining is applied to fifteen scattered sections from 350 ft. to 1,450 ft. long each, on canal section between Sta. 51-50 and Sta. 691-46.

CONDITIONS: Canal sides on 1½:1 slopes are to be covered with selected earth 24 ft. wide on horizontal plane. All lining below 1 ft. above high water to be placed in layers 6 in. thick compacted with twelve rollings of sheepsfoot roller; lining above that level to be uncompacted placed in 12-in. layers. Canal surface to be plowed and sprinkled before applying first layer. Material to come from eight approved borrow pits, haul 500 ft. to 8,000 ft. over contractor's own roads. Water up to optimum moisture content to be added at pits; additional sprinkling at fill if required. Minimum wage rates specified vary from 50c. to $1.10.

BIDS: Nine bids opened Sept. 2, 1937, under U.S.B.R. Spec. 744. Range of bids $147,462 to $222,820.

LOW BIDDERS:

1. A. S. Vinnell Co., Alhambra, Cal. $147,462
2. Zybach & Trowbridge, Columbus, Nebr. 147,642
3. Kuhn Bros., Inc., Manhattan Beach, Cal. 158,584

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Compacted lining	243,200 c. y.	$0.56	$0.5475	$0.615
2. Uncompacted lining	64,400 c. y.	.175	.225	.14

PENNSYLVANIA HIGHWAYS

OWNER: State Highway Department, Harrisburg, Pa.

PROJECT: Construction of reinforced concrete bridge, 2,387 ft. long, 538 ft. of reinforced concrete pavement, widening existing pavement and 212 ft. shoulder grading, in Northumberland Co. Shamokin Twp.

BIDS: Six bids were opened in September, 1937, ranging from a low of $45,765 to a high of $54,506.

LOW BIDDERS:

1. Angelo Christiana, Shamokin, Pa. $45,765
2. Paul E. Rarick, Zions Grove, Pa. 47,522
3. D. A. Kessler Const. Co., Inc., Mt. Carmel, Pa. 48,582

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Clear, grub	L. S.	$250.00	$200.00	$300.00
2. Excavation, cl. 1	22,042 c. y.	.58	.48	.60
3. Excavation, cl. 2	552 c. y.	2.00	2.25	2.00
4. Subgrade	5,949 s. y.	.12	.18	.20
5. Shoulders	2,768 l. f.	.15	.25	.25
6. Base course, nat. st., cu. agg.	620 s. y.	.90	1.10	1.00
7. Concrete pavement, H. E. S. Pl.	12 s. y.	2.50	3.00	3.00
8. Conc. pavt. RC., H. E. S.	5,317 s. y.	2.97	3.40	3.00
9. RC wearing surf., H. E. S.	175 s. y.	2.50	2.50	2.00
10. Concrete cl. A, H. E. S.	143 c. y.	21.00	22.00	24.00
11. Concrete cl. B	212 c. y.	18.00	18.00	20.00
12. Plain steel bars	33,337 lb.	.05	.05	.06
13. Plain struct. steel	1,761 lb.	.07	.09	.10
14. Temp. bridge, approach, 1 lane	L. S.	500.00	750.00	200.00
15. Cement rubble masonry	10 c. y.	15.00	15.00	18.00
16. Endwall, F. rails	1 ea.	90.00	100.00	150.00
17. Inlets, type E	2 ea.	70.00	75.00	75.00
18. Cast iron pipe, 18 in.	105 l. f.	3.00	3.50	4.00
19. Corr. metal pipe, 18 in.	42 l. f.	3.00	2.75	3.00
20. C. M. pipe, asphalt coated, 18 in.	64 l. f.	3.20	3.10	3.50
21. C. M. pipe, asphalt coated, 60 in.	62 l. f.	15.00	18.00	15.00
22. Reinf. conc. pipe, 12 in.	22 l. f.	2.00	2.25	2.25
23. Reinf. conc. pipe, 15 in.	10 l. f.	2.50	2.50	3.50
24. Plain pipe, 6 in., conc. or v.c.	26 l. f.	1.50	1.00	1.25
25. Title outlets, 4 in.	80 l. f.	1.00	.70	1.00
26. Underdrain, 4 in. por. conc. or perf. vit. clay	796 l. f.	1.00	.70	1.00
27. Subgrade drains	200 l. f.	.40	.40	.50
28. Plain conc. gutter	232 s. y.	2.40	3.00	2.50
29. Guard fence, Type 1B	768 l. f.	.60	.85	.75
30. End anchors, type AB	7 ea.	12.00	17.00	16.00
31. Bit. surface crse. HE1, HE9	75 ton	6.00	6.50	7.00

COLORADO RIVER PIPELINE

OWNER: Metropolitan Water District, Los Angeles, Cal.; F. E. Weymouth, Chief Engineer.

PROJECT: Constructing Palos Verde feeder of Colorado River Aqueduct, in City and County of Los Angeles, South Pasadena and Vernon, involving 17.4 miles of pipe line from South Pasadena. The project is divided into three sections: Schedule 21, 5.5 miles; Schedule 22, 5.4 miles; and Schedule 23, 6.5 miles. Alternative bids were invited on 50 and 51 in. precast concrete pipe, 42 in. centrifugally cast concrete pipe, 51 and 55 in. unlined welded steel pipe with Gunite exterior coating, 53 and 57 in. Gunite coated welded steel pipe with coal tar enamel lining, and 51 and 55 in. Gunite coated welded steel pipe with spun mortar lining and Gunited joints.

BIDS: Opened September 1, 1937. Of the twelve bidders, on the first section, two bids were submitted for the precast pipe, $731,193 and $764,952; on the second section, three bids, from $683,662 to $737,690; and on the third section, two bids of $922,769 and $938,680. For the unlined welded steel pipe with Gunite exterior, ten bids on the first section ranged from $728,018 to $1,085,162; on the second section nine bids from $683,910 to $880,916; and on the third section eight bids from $843,484 to $1,046,642. For the Gunite coated welded steel pipe with spun mortar lining and Gunited joints, eleven bids on the first section from $756,796 to $1,138,571; on the second section, ten bids from $684,158 to $934,826; and on the third section, nine bids from $872,501 to $1,102,516. For the Gunite coated welded steel pipe with coal tar enamel lining, twelve bids on the first section ranged from $757,312 to $1,120,189; on the second section eleven bids from $674,674 to $916,709; and on the third section ten bids from $887,134 to $1,103,502. The tabulations below give all quantities and units for the precast pipe schedule but omit any repetition of quantities which might occur in the alternative schedules.

CONDITIONS: Completion is scheduled for December, 1938, with minimum hourly wage rates stipulated of $1.10 for skilled and 60c. for common labor. Heavy timbering is required and difficulties are anticipated in tunnel construction. Contractor furnishes all materials other than cement, paint, primer, enamel, joint rings, gaskets, wire mesh reinforcing for Gunite exteriors, reinforcing bars not in precast pipe, piping, fittings, valves, metal work and miscellaneous equipment, meters, slide gates, etc.

LOW BIDDERS:

I — SCHED. 21P — 54-IN. PRECAST CONCRETE PIPE

1. United Concrete Pipe Corp., Los Angeles, Calif. $731,193
2. American Conc. & Steel Pipe Co., Los Angeles, Calif. 764,952

Item	Quan.	Unit Prices (1)	(2)
1. Trench excavation	148,000 c. y.	$0.60	$0.81
2. Structure excavation	1,400 c. y.	1.10	2.50
3. Tunnel, adit excavation	4,300 c. y.	8.00	13.00

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